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FIFTH ANNUAL REPORT

OF THE

BOARD OF CONTROL

OF THE

STATE

AGRICULTURAL EXPERIMENT STATION

AT

AMHERST, MASS.

1887.

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MASSACHUSETTS STATE
AGRICULTURAL EXPERIMENT STATION,
AMHERST, MASS.

BOARD OF CONTROL, 1887.

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* Left July 1, 1887. † Left April 1, 1887.

Boston, Jan. 11, 1888.

To the Honorable the Governor and Council, State of Massachusetts.

In accordance with the law of the State, I have the honor to present the Fifth Annual Report of the Board of Control of the State Agricultural Experiment Station.

ALVAN BARRUS,
Secretary.

FIFTH ANNUAL REPORT

OF THE

DIRECTOR OF THE STATE AGRICULTURAL EXPERIMENT STATION AT AMHERST, MASS.

To the Honorable Board of Control.

GENTLEMEN: — The advantages expected from a better outfit in the chemical laboratory, the feeding department and the field have been fairly realized during the past year. The examinations carried on in the laboratory have been more varied and more numerous; the feeding experiments have received deservedly an increased attention; and the assignment of fields for definite lines of investigation has been advanced wherever circumstances have advised that course.

The laboratory building is in a good state of repair. The supply of new apparatus has been regulated by the means at our disposal for that purpose. Much has been accomplished in that way; more still remains to be done to meet the constant demands, arising partly from an unavoidable destruction of apparatus and partly from new inquiries into more intricate subjects of animal and vegetable economy.

The stalls lately built for a better accommodation of horses, cattle and swine have been completed according to designs. Ample provisions have been made to supply them with hot and cold water when needed. A new milk-setting room and an ice-house have just been finished to complete the outfit for observations concerning the products of the dairy. Some additional plain structures will be needed before long, to provide rooms for experiments with sheep and growing cattle.

The barn and adjoining sheds are well preserved. Some parts of them have been transformed into a balance room, a feed room, a seed room, a tool room and workshop, and an office, aside from some root pits and silos.

The dwelling-house of the farmer is, as far as circumstances permit, in a satisfactory condition. The building will soon need, however, in common with some of the older farm buildings, a new coat of paint.

The work in the field has been greatly increased, in consequence of the recent addition of an area of thirty acres of land. These lands are located on the east side of the highway, and consist of ten acres of wood land and of twenty acres of worn-out grass land. Twelve acres of the latter, which had been underdrained, graded and ploughed during the preceding year, were utilized during the past season for the raising of potatoes, corn, horse bean, squashes, oats and barley. Most of the crops succeeded fairly, while others suffered seriously from frequent and heavy rainfalls during the months of July and August. The lower part of this portion of the lands, about four acres in size, has been seeded down into a permanent meadow. The upper part will be again planted with some general farm crop, to renovate it, by drill cultivation, for future experiments. The remaining eight acres of old grass land have been extensively underdrained during the latter part of the autumn and subsequently ploughed. These lands are designed to serve ultimately in part for the cultivation of general farm crops and for a fruit orchard for experimental purposes.

The lands located on the west side of the high road have been resurveyed, and the outlines of each experimental field marked by painted gas pipes; the latter are buried four feet in the soil, to prevent the shifting of the markers and to serve the farmer as future guides in ploughing, etc. The entire area of ploughed land is divided into four distinct fields, named A, B, C, D, of which there is a complete record of their past history.

The experimental work carried on in the barn, the fields and the laboratory of the Station during the past years is described in the subsequent pages under the following headings:—

1. Experiments with milch cows; English hay, corn fodder, fodder corn, ensilage, roots, etc.
2. Experiments with milch cows; with green fodder, vetch and oats, Southern cow pea, serradella, etc.
3. Experiments with pigs; with skim-milk, corn meal, gluten meal, and wheat bran.
4. On fodder supply and analyses of fodder articles.
5. Fodder corn raised with single articles of plant food.
6. Fodder crops raised with and without complete manure.
7. Experiments with wheat, vetch and oats, serradella, and Southern cow pea.
8. Experiments with potatoes, roots, and miscellaneous crops.
9. Suggestions upon planting trees and small fruits, by Prof. S. T Maynard.
10. Fertilizer and fertilizer analyses; miscellaneous analyses.
11. Well-water analyses.
12. Compilation of analyses of fodder articles with reference to food value.
13. Compilation of analyses of fodder articles with reference to fertilizing ingredients.
14. Compilation of analyses of agricultural chemicals and refuse materials used for fertilizing purposes.
15. Meteorological observations.

From the previous enumeration of subjects reported on, it will be noticed that some of them are reports of progress, regarding questions for one or two years already under investigation; while others are new additions to the work assigned.

This feature in the communications on experimental work is but natural when remembering that one year's observation in field work does only in exceptional cases entitle to a final conclusion.

Some compilations of our previous analyses of fodder articles, agricultural chemicals and refuse material from various branches of industry have been added for the purpose of placing permanently on record for reference certain facts concerning these materials. These abstracts cannot otherwise but prove acceptable to the farmers of the State.

The tabular statement of the extremes of temperature at Amherst, Mass., from the year 1836 to 1888, has been prepared at the special request of the U. S. Forestry department.

The periodical publications of the Station have been as numerous as in previous years. The interest in the bulletins

and annual reports has been steadily growing during the past year. The number of bulletins printed has been raised from 5,000 in 1886 to 6,000 in 1887, and will be increased to 7,000 early in the coming season.

It gives me particular pleasure to bear testimony to the satisfactory support I have had from all parties engaged with me in the work of the Station.

In conclusion permit me to thank you very sincerely for the liberal support I have enjoyed in performing the duties assigned to me.

Yours very respectfully,

C. A. GOESSMANN,
Director of the State Agricultural Experiment Station.

ON FEEDING EXPERIMENTS.

I. Feeding Experiments with Milch Cows; English Hay, Corn Fodder, Fodder Corn, Ensilage, Roots, etc.

II. Feeding Experiments with Milch Cows; with Green Fodder, Vetch and Oats, Southern Cow Pea, Serradella, etc.

III. Feeding Experiments with Pigs; Skim-milk, Corn Meal, Gluten Meal and Wheat Bran.

I. Feeding Experiments with Milch Cows.

The feeding experiments with milch cows reported within a few subsequent pages are essentially a continuation of those described in the fourth annual report of the Station (1886–1887). To compare the feeding effect of dried fodder corn, corn fodder (stover), and corn ensilage as a substitute, in whole or in part, for English hay, and that of corn ensilage as compared with that of roots, under otherwise corresponding circumstances, has been the principal object of our work on both occasions.

The same fodder articles have been used in both trials, with the exception that in the experiments discussed below carrots have been taken instead of sugar beets, which were used in the preceding year. Aside from this temporary modification in the diet, a comparatively new fodder article, the gluten meal, has been added as a temporary ingredient of the daily fodder ration. This particular change in the composition of the feed used was made for the purpose of securing, whenever desired, a closer numerical relation between the digestible nitrogenous and non-nitrogenous organic constituents of the food consumed as compared with that which served in our previous experiments. The gluten meal was chosen from among the various concentrated com-

mercial feed-stuffs on account of its close relation to corn, of which it constitutes a part, and its higher nitrogenous character when compared with that of the corn meal and the wheat bran (shorts).

Three cows, mixed breed, from five to six years old, were selected for our work. They were practically in the same milking period, from three to six weeks after calving, at the beginning of the trial. The observation extended over a period of seven months, — October 1, 1886, to April 24, 1887.

The temporary changes in the diet, wherever decided upon, were carried out gradually, as it is customary in all carefully conducted feeding experiments. At least five days are allowed in every instance to pass by, in case of a change in the character of the feed, before the daily observations of the results appear in our published records. The dates which accompany all detailed reports of our feeding experiments, past and present, furnish exact figures in that direction. This is, in particular, the case whenever such statements are of a special interest, for an intelligent appreciation of the final conclusions presented.

As our feeding experiments with milch cows were originally undertaken with the intention of carrying out a systematic course of inquiry into the economical relations of the production of milk with reference to the dairy industry, as well as to a practical general farm management, it was thought best, for various reasons, to begin our work with cows of moderate milking qualities. The effect of different diets on the quantity and quality of the milk produced, as well as their bearing on the net cost of production, promised to be of particular interest under the stated circumstances. A beginning of our work at the lower end of the scale of the production of milk offered besides, the particular advantage that the results obtained, by a careful mode of observation, might find a direct application to a still quite numerous class of cows on our farms, which are not infrequently assumed to be of but little merit from an economical standpoint. It is our intention to publish, as soon as practicable, a statement concerning the annual yield of milk of some of our cows at present on trial, and also the net cost of its production, as

far as the feed is concerned, to show more plainly the annual profits of keeping cows of moderate milking qualities.

The daily diet of the cows consisted, at the beginning of the experiments, of three and one-quarter pounds of corn meal, an equal weight of wheat bran, and all the hay they could eat. The actual amount of hay consumed in each case was ascertained by daily weighing out a liberal supply of it, and deducting subsequently the hay left over.

The statement in our records below refers to the average consumption of hay per day during the feeding period.

The above stated combination of fodder articles was adopted as the basis of our investigation mainly for the reason that it had been used with satisfactory results in some of our earlier feeding experiments, and not on the assumption of its being the best possible combination of fodder articles for milch cows. The weights of the animals were taken on the same day of each week before milking and feeding.

The valuation of the various fodder articles consumed is based on the local market price per ton in Amherst when used.

Good English hay, .	$15.00.	Rye middlings, . .	$24.00.
Corn meal, . . .	23.00.	Dry corn fodder (stover),	5.00.
Wheat bran, . . .	20.00.	Corn ensilage, . .	2.75.
Gluten meal, . . .	23.00.	Carrots, ...	7.00.

The *value* of a fodder for dairy purposes may be stated from *two distinctly different standpoints;* namely, with reference to its *influence on the temporary yield of milk* and *the general condition of the animals* which consume it, and in regard to its *first cost*, — i. e., its *physiological* and *commercial value.*

The market value and the actual feeding effect of one and the same article do not necessarily correspond with each other; in fact, they rarely coincide.

The market value may be stated for each locality by one definite number. The feeding effect of one and the same substance, simple or compound, *varies* under *different circumstances*, and depends in a controlling degree on its *judicious use in compounding diets.*

As no single plant or part of plant has been found to supply economically and efficiently, to any considerable extent,

the wants of our various kinds of farm stock, it becomes a matter of first importance to learn how to supplement our leading farm crops to meet the divers wants of each kind. To secure the highest feeding value of each article of fodder is most desirable in the interest of good economy. The judicious selection of ingredients for a suitable and remunerative diet for our dairy stock obliges us, therefore, to study the value of the fodder articles at our disposal from both standpoints.

The chemical analyses of the various articles used in the combination of fodder in our case are stated in some succeeding pages to show their character and their respective quality. To ascertain the chemical composition of a fodder ration, in connection with an otherwise carefully managed feeding experiment, enables us to recognize with more certainty the causes of the varying feeding effects of one and the same fodder article when fed in different combinations. It furnishes, also, a most valuable guide in the selection of suitable *commercial feed stuffs* from *known sources* to supplement economically our home-raised fodder crops. Practical experience in feeding stock has so far advanced that it seems to need no further argument to accept it as a matter of fact that the efficiency of a fodder ration in the dairy does not depend, aside from its general or special adaptation, on the mere presence of more or less of certain prominent fodder articles, but on the presence of a proper quantity and a certain relative proportion of certain prominent constituents of plants, which are known to be essential for a successful support of life and of the special functions of the dairy cow.

Investigations into the relations which the various prominent constituents of plants bear to the support of animal life have rendered it advisable to classify them, in this connection, into *three* groups, — *mineral constituents*, and *nitrogenous* and *non-nitrogenous organic constituents*. For details regarding this matter I have to refer to previous publications of the Station. (See Fourth Annual Report, pages 31–37.) Numerous and extensive practical feeding experiments with most of our prominent fodder articles in various conditions, and with all kinds of farm live stock, have introduced the practice of reporting, in connection with the analysis of the

chemist, also, the result of careful feeding experiments, as far as the various fodder articles have proved digestible, and were thus qualified for the support of the life and the functions of the particular kind of animal on trial. In stating the amount of the digestible portion of the fodder consumed in a feeding experiment, it has proved useful, for comparing different fodder rations, etc., to make known by a distinct record the relative proportion which has been noticed to exist between the amount of its digestible nitrogenous and non-nitrogenous organic constituents. This relation is expressed by the name of "Nutritive Ratio." An examination of the subsequent short description of our feeding experiments will show, for instance, that the corn meal fed contained one part of digestible nitrogenous to 8.76 parts of digestible non-nitrogenous organic matter, making the customary allowance for the higher physiological value of the fat as compared with that of starch, sugar, etc. (2.5 times higher). The "Nutritive Ratios" of the articles of feed consumed are subsequently stated, as follows: —

Corn meal, . . .	1 : 8.76.	English hay, . .	1 : 9.5.
Wheat bran, . .	1 : 3.47.	Dry corn fodder, . .	1 : 9.3.
Gluten meal, . .	1 : 2.67.	Corn ensilage, . .	1 : 11.9.
Rye middlings, . .	1 : 7.28.	Carrots, . . .	1 : 9.24.

The results of our own analyses of these fodder articles are here turned to account for the calculation of the above stated "Nutritive Ratios."

It has been noticed that, as a general rule, growing animals and milch cows require a richer food, i. e., a closer relation of digestible nitrogenous and non-nitrogenous organic constituents in their feed, to do their best, than full-grown animals and moderately worked horses or oxen. German investigators recommend a combination of fodder articles, in other respects suitable, which contains one part of digestible nitrogenous organic constituents to 5.4 parts of digestible non-nitrogenous constituents.

From the description of our earlier feeding experiments with milch cows (see Fourth Annual Report, page 11), it may be observed, that the relations of the digestible nitrogenous and non-nitrogenous organic constituents in the different combinations of fodder articles which constituted, during the

various feeding periods, the daily diet of the cows, varied on that occasion from 1 : 6.7 to 1 : 10.17. The closer relation was obtained by feeding on an average, daily, —

$3\frac{1}{4}$ lbs. of wheat bran,
15 lbs. of hay,
40 lbs. of Lane's sugar beet,
} Nutritive ratio, 1 : 6.7.

And the wider ratio by feeding daily on an average, —

$3\frac{1}{4}$ lbs. of corn meal,
5 lbs. of hay,
$41\frac{3}{4}$ lbs. of corn ensilage,
} Nutritive ratio, 1 : 10.17.

(See Daisy.) During our more recent feeding experiments described below, on the whole, closer relations are adopted than before. The relations between the two above stated important groups of fodder constituents vary from 1 : 5.9 to 1 : 7.9; they are also more uniform during the various feeding periods. The closer relation is obtained by feeding daily on an average, —

$3\frac{1}{4}$ lbs. of corn meal,*
$3\frac{1}{4}$ lbs. of wheat bran,*
$3\frac{1}{4}$ lbs. of gluten meal,
10 lbs. of hay,
35 lbs. of carrots,
} Nutritive ratio, 1 : 5.9.

and the wider ratio by feeding daily on an average, —

$3\frac{1}{4}$ lbs. of corn meal,
$3\frac{1}{4}$ lbs. of wheat bran,
25 lbs. of hay,
} Nutritive ratio, 1 : 7.9.

(See Dora.) The entire recent feeding experiment (I.) is subdivided into eight distinctly different feeding periods; the same number as on the preceding occasion, for the same length of time, — seven months.

The dry corn fodder, the ensilage and the roots were cut, before being offered as feed. The exact amount consumed of each fodder article was ascertained by taking their weights before feeding and deducting the amount left, if any. Grain and roots were usually fed during milking, and the coarse fodder between times.

* $3\frac{1}{4}$ lbs. of wheat bran is equal to four quarts; and $3\frac{1}{4}$ lbs. of corn meal is equal to two quarts.

A careful examination of our subsequently tabulated feeding records of each cow (Susie, Meg and Dora), leads apparently with much propriety, among others, to the following conclusions: —

The *nutritive* value of our dry corn fodder compares well with that of an average quality of English hay; the same may be said of good corn ensilage in place of from one-half to two-thirds of the customary amount of hay.

The *nutritive* value of our dry corn fodder (stover) and of a good corn ensilage, taking into consideration pound for pound of the dry vegetable matter they contain, has proved in our case fully equal, if not superior, to that of the average English hay.

The *nutritive* feeding value of carrots, taking into consideration pound for pound of the dry matter they contain, exceeds that of the corn ensilage as an ingredient of the daily diet, in place of a part (one-half) of the hay fed. The conclusions thus far stated are in full agreement with those pointed out in our earlier experiments.

The influence of the *various diets* used, on the *quality* of the milk, seems to depend in a controlling degree on the constitutional characteristics of the animal on trial. The effect is not unfrequently in our case the reverse in different animals depending on the same diet.

The yield of the milk decreased, although at a different rate, in the case of different animals as time advanced. The shrinkage in the daily yield of milk amounted, at the end of the entire experiment, to from 3.2 quarts to 4.9 quarts in case of different cows. The gradual decline in the entire milk record of every cow is only once broken; namely, during the sixth feeding period, Feb. 7th to Feb. 21st, when the yield of milk shows an increase of from .7 to 1.9 quarts per day, as compared with that of the preceding period. This change for the better was noticed when ten pounds of hay and thirty-four pounds of carrots were used, under otherwise corresponding circumstances, as a substitute for five pounds of hay and twenty-nine pounds of corn ensilage; the amount of dry vegetable matter contained in the hay fed with roots and in the hay fed with corn ensilage was practically the same in both instances. The feed of the sixth

feeding period, containing carrots as an ingredient, is thus the most nutritive and also the most expensive.

The total cost of the feed consumed for the production of milk is lowest wherever corn fodder or corn ensilage have replaced, in the whole or in part, English hay, under otherwise corresponding circumstances.

The net cost of feed consumed for the production of one quart of milk, during the various feeding periods, varies as widely as from .34 cents to 1.6 cents in case of the same cow. The net cost of the feed is obtained by deducting 80 per cent. of the value of the fertilizing constituents it contains.

The manurial value of the feed consumed during the entire feeding experiment, deducting 20 per cent. for the amount of fertilizing constituents lost in the production of milk, is, at current market rates, in every instance, more than equal to one-third of the original cost of the feed.

Two cows gained from 60 to 66 pounds in live weight during the trial; and one—the best milker, Dora—held practically her own from beginning to end.

For further details see the following pages. To avoid misconstruction regarding the statement of net cost of milk used in our description, I state once more that it does not include expenses for labor, housing, interest on investment, etc., but means merely net cost of feed after deducting 80 per cent. of its manurial value.

SUSIE: AGE, FIVE YEARS; GRADE, AYRSHIRE; LAST CALF, JULY 14, 1886.

FEEDING PERIODS.	FEED CONSUMED (POUNDS) PER DAY.								Amount of dry vegetable matter contained in the daily fodder consumed (in pounds).	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Average weight of animal during each feeding period.
	Wheat Bran.	Corn Meal.	Gluten Meal.	Rye Middlings.	Hay.	Ensilage.	Corn Fodder.	Roots (Carrots).					
1886.													
1. Oct. 1 to 25, ...	3.25	3.25	–	–	24.92	–	–	–	28.59	13.5	2.11	1:7.9	855
2. Nov. 1 to 16, ...	3.25	3.25	3.25	–	19.03	–	–	–	26.15	13.2	1.98	1:6.1	877
3. Dec. 6 to 13, ...	–	3.25	3.25	3.25	20.00	–	–	–	27.65	11.8	2.35	1:6.8	883
4. Dec. 21 to 31, ...	3.25	3.25	–	–	–	–	21.36	–	23.81	11.9	2.00	1:7.7	883
1887.													
5. Jan. 18 to 31, ...	3.25	3.25	3.25	–	5.00	32.79	–	–	22.60	11.0	2.06	1:6.4	897
6. Feb. 7 to 21, ...	3.25	3.25	3.25	–	10.00	–	–	35.00	21.36	12.9	1.66	1:5.9	914
7. Mar. 9 to 25, ...	3.25	3.25	3.25	–	20.00	–	–	–	27.00	11.1	2.42	1:6.2	951
8. Apr. 6 to 24, ...	3.25	3.25	3.25	–	18.95	–	–	–	26.07	9.4	2.76	1:6.1	1,019

MEG: Age, Six Years; Grade, Devon; Last Calf, Aug. 2, 1886.

Feeding Periods.	Feed Consumed (pounds) per day.								Amount of dry vegetable matter contained in the daily fodder consumed (in pounds).	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Average weight of animal during each feeding period.
	Wheat Bran.	Corn Meal.	Gluten Meal.	Rye Middlings.	Hay.	Ensilage.	Corn Fodder.	Roots (Carrots).					
1886.													
1. Oct. 1 to 25,	3.25	3.25	–	–	25.00	–	–	–	28.66	13.9	2.06	1 : 7.9	1,023
2. Nov. 1 to 16,	3.25	3.25	3.25	–	19.34	–	–	–	26.44	13.2	2.00	1 : 6.1	1,049
3. Dec. 6 to 13,	–	3.25	3.25	3.25	20.00	–	–	–	27.65	12.9	2.15	1 : 6.8	1,078
4. Dec. 21 to 31,	3.25	3.25	–	–	–	–	17.59	–	20.62	12.0	1.72	1 : 7.5	1,023
1887.													
5. Jan. 18 to 31,	3.25	3.25	3.25	–	5.00	25.25	–	–	20.46	10.3	1.98	1 : 6.1	1,055
6. Feb. 7 to 21,	3.25	3.25	3.25	–	10.00	–	–	35.00	21.36	11.0	1.94	1 : 5.9	1,083
7. Mar. 9 to 25,	3.25	3.25	3.25	–	20.00	–	–	–	27.00	10.9	2.50	1 : 6.2	1,087
8. Apr. 6 to 24,	3.25	3.25	3.25	–	18.95	–	–	–	26.07	10.7	2.43	1 : 6.1	1,149

DORA: Age, Six Years; Grade, Devon; Last Calf, Sept. 6, 1886.

Feeding Periods.	Feed Consumed (pounds) per day.								Amount of dry vegetable matter contained in the daily fodder consumed (in pounds).	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Average weight of animal during each feeding period.
	Wheat Bran.	Corn Meal.	Gluten Meal.	Rye Middlings.	Hay.	Ensilage.	Corn Fodder.	Roots (Carrots).					
1886.													
1. Oct. 1 to 25,	3.25	3.25	–	–	23.00	–	–	–	26.86	16.3	1.65	1 : 7.8	882
2. Nov. 1 to 16,	3.25	3.25	3.25	–	17.70	–	–	–	24.92	15.7	1.59	1 : 6.0	859
3. Dec. 6 to 13,	–	3.25	3.25	3.25	20.00	–	–	–	26.98	14.6	1.85	1 : 6.8	889
4. Dec. 21 to 31,	3.25	3.25	–	–	–	–	19.77	–	22.46	14.0	1.60	1 : 7.7	851
1887.													
5. Jan 18 to 31,	3.25	3.25	3.25	–	5.00	28.64	–	–	21.42	12.8	1.68	1 : 6.2	856
6. Feb. 7 to 21,	3.25	3.25	3.25	–	10.00	–	–	35.00	21.36	13.5	1.58	1 : 5.9	855
7. Mar. 9 to 25,	3.25	3.25	3.25	–	20.00	–	–	–	27.00	12.2	2.21	1 : 6.2	836
8. Apr. 6 to 24,	3.25	3.25	3.25	–	18.95	–	–	–	26.07	11.7	2.23	1 : 6.1	877

Total Cost of Feed per Quart of Milk.

(SUSIE.)

FEEDING PERIODS.	Total quantity of Milk produced during entire period.	Average daily yield of Milk for period.	Total amount of Wheat Bran consumed during period.	Total amount of Corn Meal consumed during period.	Total amount of Gluten Meal consumed during period.	Total amount of Rye Middlings consumed during period.	Total amount of Hay consumed during period.	Total amount of Ensilage consumed during period.	Total amount of Corn Fodder consumed during period.	Total amount of Roots (Carrots) consumed during period.	Total cost of Feed consumed during period.	Average cost of Feed for production of one qt. of Milk for period.
1886.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. Oct. 1 to 25,	338.6	13.5	81.25	81.25	–	–	623.0	–	–	–	$6 41	1.89
2. Nov. 1 to 16,	211.3	13.2	52.00	52.00	52.00	–	304.5	–	–	–	4 00	1.89
3. Dec. 6 to 13,	94.0	11.8	–	28.00	28.00	28.00	160.0	–	–	–	2 18	2.31
4. Dec. 21 to 31,	130.5	11.9	35.75	35.75	–	–	–	–	235.0	–	1 36	1.04
1887.												
5. Jan. 18 to 31,	153.3	11.0	45.50	45.50	45.50	–	70.0	459.0	–	–	2 66	1.74
6. Feb. 17 to 21,	193.5	12.9	48.75	48.75	48.75	–	150.0	–	–	525.0	4 58	2.37
7. Mar. 9 to 25,	189.8	11.1	55.25	55.25	55.25	–	340.0	–	–	–	4 38	2.31
8. Apr. 6 to 24,	179.0	9.4	61.75	61.75	61.75	–	360.0	–	–	–	3 84	2.15

Total Cost of Feed per Quart of Milk.

(MEG.)

FEEDING PERIODS.	Total quantity of Milk produced during entire period.	Average daily yield of Milk for period.	Total amount of Wheat Bran consumed during period.	Total amount of Corn Meal consumed during period.	Total amount of Gluten Meal consumed during period.	Total amount of Rye Middlings consumed during period.	Total amount of Hay consumed during period.	Total amount of Ensilage consumed during period.	Total amount of Corn Fodder consumed during period.	Total amount of Roots (Carrots) consumed during period.	Total cost of Feed consumed during period.	Average cost of feed for production of one qt. of Milk for period.
1886.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. Oct. 1 to 25,	347.8	13.9	81.25	81.25	–	–	625.0	–	–	–	$6 43	1.85
2. Nov. 1 to 16,	211.0	13.2	52.00	52.00	52.00	–	309.5	–	–	–	4 04	1.91
3. Dec. 6 to 13,	103.0	12.9	–	28.00	28.00	28.00	160.0	–	–	–	2 18	2.12
4. Dec. 21 to 31,	132.0	12.0	35.75	35.75	–	–	–	–	193.5	–	1 25	.95
1887.												
5. Jan. 18 to 31,	144.5	10.3	45.50	45.50	45.50	–	70.0	353.5	–	–	2 51	1.74
6. Feb. 7 to 21,	165.5	11.0	48.75	48.75	48.75	–	150.0	–	–	525.0	4 57	2.76
7. Mar. 9 to 25,	184.0	10.9	55.25	55.25	55.25	–	340.0	–	–	–	4 38	2.38
8. Apr. 6 to 24,	203.3	10.7	61.75	61.75	61.75	–	360.0	–	–	–	3 84	1.90

Total Cost of Feed per Quart of Milk.

(DORA.)

FEEDING PERIODS.	Total quantity of Milk produced during entire period.	Average daily yield of Milk for period.	Total amount of Wheat Bran consumed during period.	Total amount of Corn Meal consumed during period.	Total amount of Gluten Meal consumed during period.	Total amount of Rye Middlings consumed during period.	Total amount of Hay consumed during period.	Total amount of Ensilage consumed during period.	Total amount of Corn Fodder consumed during period.	Total amount of Roots (Carrots) consumed during period.	Total cost of Feed consumed during period.	Average cost of Feed for production of one qt. of Milk for period.
1886.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. Oct. 1 to 25,	408.0	16.3	81.25	81.25	–	–	576.0	–	–	–	$6 05	1.48
2. Nov. 1 to 16,	251.5	15.7	52.00	52.00	52.00	–	283.0	–	–	–	3 84	1.53
3. Dec. 6 to 13,	116.5	14.6	–	28.00	28.00	28.00	160.0	–	–	–	2 18	1.87
4. Dec. 21 to 31,	154.0	14.0	35.75	35.75	–	–	–	–	217.5	–	1 31	.85
1887.												
5. Jan. 18 to 31,	179.0	12.8	45.50	45.50	45.50	–	70.0	401.0	–	–	2 58	1.44
6. Feb. 7 to 21,	203.0	13.5	48.75	48.75	48.75	–	150.0	–	–	525.0	4 58	2.26
7. Mar. 9 to 25,	208.0	12.2	55.25	55.25	55.25	–	340.0	–	–	–	4 38	2.11
8. Apr. 6 to 24,	222.3	11.7	61.75	61.75	61.75	–	360.0	–	–	–	3 84	1.73

Summary of Net Cost of Feed for each Cow during succeeding Periods.

PERIODS.	Total Cost of Feed Consumed during Period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting the 20 per cent. taken by the Milk.	Net Cost of Feed for the Production of Milk during the Period.	Net Cost of Feed for the Production of one quart of Milk.	Weight of Animal at close of Period.
					Cents.	Lbs.
1. Susie, . .	$6 41	$2 72	$2 18	$4 23	1.24	861
Meg, . .	6 43	2 72	2 18	4 25	1.22	1,030
Dora, . .	6 05	2 58	2 06	3 99	.98	860
2. Susie, . .	4 00	1 92	1 54	2 46	1.16	896
Meg, . .	4 04	1 92	1 54	2 50	1.18	1,055
Dora, . .	3 84	1 85	1 48	2 36	.94	876
3. Susie, . .	2 18	92	74	1 44	1.53	883
Meg, . .	2 18	92	74	1 44	1.40	1,056
Dora, . .	2 18	92	74	1 44	1.24	884
4. Susie, . .	1 36	1 00	80	56	.43	876
Meg, . .	1 25	89	71	54	.41	1,020
Dora, . .	1 31	96	78	53	.34	844
5. Susie, . .	2 66	1 48	1 18	1 48	.97	905
Meg, . .	2 51	1 39	1 11	1 41	.98	1,070
Dora, . .	2 58	1 43	1 14	1 44	.80	860
6. Susie, . .	4 58	1 67	1 34	3 24	1.67	921
Meg, . .	4 58	1 67	1 34	3 24	1.96	1,096
Dora, . .	4 58	1 67	1 34	3 24	1.60	852
7. Susie, . .	4 38	2 09	1 67	2 71	1.43	967
Meg, . .	4 38	2 09	1 67	2 71	1.47	1,101
Dora, . .	4 38	2 09	1 67	2 71	1.30	831
8. Susie, . .	3 84	2 27	1 82	2 02	1.13	1,060
Meg, . .	3 84	2 27	1 82	2 02	.99	1,170
Dora, . .	3 84	2 27	1 82	2 02	.91	885

Summary.

SUSIE.

Total amount of milk produced during above records,	1,490 qts.
Total cost of feed per quart of milk produced,	1.97 cts.
Manurial value left behind per quart of milk produced,	.75 cts.
Net cost per quart of milk produced,	1.22 cts.

MEG.

Total amount of milk produced during above records,	1,491.1 qts.
Total cost of feed per quart of milk produced,	1.96 cts.
Manurial value left behind per quart of milk produced.	.75 cts.
Net cost per quart of milk produced,	1.21 cts.

DORA.

Total amount of milk produced during above records,	1,742.3 qts.
Total cost of feed per quart of milk produced,	1.65 cts.
Manurial value left behind per quart of milk produced,	.64 cts.
Net cost per quart of milk produced,	1.01 cts.

Manurial Value of Feed.

SUSIE.

FEEDING PERIODS.	Total Cost of Feed Consumed during Period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting the 25 per cent. taken by the Milk.	Net Cost of Feed for the Production of Milk during Period.	Net Cost of Feed for the Production of one quart of Milk.	Weight of Animal at close of Period.
1886.					Cents.	Lbs.
1. Oct. 1 to 25,	$6 41	$2 72	$2 18	$4 23	1.24	861
2. Nov. 1 to 16,	4 00	1 92	1 54	2 46	1.16	896
3. Dec. 6 to 13,	2 18	92	74	1 44	1.53	883
4. Dec. 21 to 31,	1 36	1 00	80	56	.43	876
1887.						
5. Jan. 18 to 31,	2 66	1 48	1 18	1 48	.97	905
6. Feb. 7 to 21,	4 58	1 67	1 34	3 24	1.67	921
7. Mar. 9 to 25,	4 38	2 09	1 67	2 71	1.43	967
8. Apr. 6 to 24,	3 84	2 27	1 82	2 02	1.13	1,060
Total,	$29 41	$14 07	$11 27	$18 14	–	–

MEG.

FEEDING PERIODS.	Total Cost of Feed Consumed during Period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting the 20 per cent. taken by the Milk.	Net Cost of Feed for the Production of Milk during Period.	Net Cost of Feed for the Production of one quart of Milk.	Weight of Animal at close of Period.
1886.					Cents.	Lbs.
1. Oct. 1 to 25, .	$6 43	$2 72	$2 18	$4 25	1.22	1,030
2. Nov. 1 to 16, .	4 04	1 92	1 54	2 50	1.18	1,055
3. Dec. 6 to 13, .	2 18	92	74	1 44	1.40	1,056
4. Dec. 21 to 31, .	1 25	89	71	54	.41	1,020
1887.						
5. Jan. 18 to 31, .	2 51	1 39	1 11	1 41	.98	1,070
6. Feb. 7 to 21, .	4 58	1 67	1 34	3 24	1.96	1,096
7. Mar. 9 to 25, .	4 38	2 09	1 67	2 71	1.47	1,101
8. Apr. 6 to 24, .	3 84	2 27	1 82	2 02	.99	1,170
Total, . .	$29 21	$13 87	$11 11	$18 11	–	–

DORA.

1886.					Cents.	Lbs.
1. Oct. 1 to 25, .	$6 05	$2 58	$2 06	$3 99	.98	860
2. Nov. 1 to 16, .	3 84	1 85	1 48	2 36	.94	876
3. Dec. 6 to 13, .	2 18	92	74	1 44	1.24	884
4. Dec. 21 to 31, .	1 31	96	78	53	.34	844
1887.						
5. Jan. 18 to 31, .	2 58	1 43	1 14	1 44	.80	860
6. Feb. 7 to 21, .	4 58	1 67	1 34	3 24	1.60	852
7. Mar. 9 to 25, .	4 38	2 09	1 67	2 71	1.30	831
8. Apr. 6 to 24, .	3 84	2 27	1 82	2 02	.91	885
Total, . .	$28 76	$13 77	$11 03	$17 73	–	–

Valuation of Essential Fertilizing Constituents contained in the various Articles of Fodder Used.

Nitrogen, 17 cents per pound; Phosphoric acid, 6 cents; Potassium oxide, 4¼ cents.

(*Per cent.*)

	Wheat Bran.	Corn Meal.	Gluten Meal.	Rye Middlings.	Hay.	Ensilage.	Corn Fodder.	Roots (Carrots).
Nitrogen, . . .	2.80	1.96	5.03	1.84	1.21	0.36	1.17	0.14
Phosphoric acid, . .	2.36	0.77	0.30	1.26	0.36	0.14	0.37	0.10
Potassium oxide, . .	1.36	0.45	0.03	0.81	1.63	0.33	1.02	0.54
Valuation per 2,000 lbs.,	$13 51	$7 97	$17 49	$8 46	$5 93	$1 68	$5 26	$1 06

Analyses of Milk.

SUSIE.

(*Per cent.*)

	1896. Oct. 22.	Nov. 3.	Nov. 30.	Dec. 14.	Dec. 31.	1897. Jan. 19.	Jan. 31.	Mar. 1.	Mar. 22.	April 21.
Water, ...	88.10	87.66	87.21	87.16	88.23	87.75	87.27	87.50	87.68	88.26
Solids, ...	11.90	12.34	12.79	12.83	11.77	12.24	12.72	12.50	12.32	11.74
Fat (in solids), . . .	3.79	3.47	4.29	3.92	3.34	3.47	4.08	3.68	3.66	3.45

MEG.

Water, ...	87.71	87.80	87.80	87.62	88.37	88.29	88.43	87.84	87.49	87.88
Solids, ...	12.29	12.20	12.20	12.38	11.63	11.71	11.57	12.16	12.51	12.12
Fat (in solids), . . .	3.69	3.36	3.30	3.64	3.16	2.98	3.11	3.45	3.55	3.64

DORA.

Water, ...	87.75	87.14	87.18	87.45	87.00	86.84	87.10	87.47	86.68	86.70
Solids, ...	12.25	12.86	12.82	12.55	13.00	13.16	12.90	12.53	13.32	13.30
Fat (in solids), . . .	3.69	3.96	3.89	3.73	3.77	3.77	3.27	3.71	3.91	3.85

HAY.

[From Experiment Station.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.30	166.00	–	–	
Dry Matter,	91.70	1,834.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.12	122.40	–	–	
" Cellulose,	30.19	603.80	350.20	58	1 : 9.5
" Fat,	2.55	51.00	23.46	46	
" Protein (Nitrogenous Matter),	9.75	195.00	111.15	57	
Non-nitrogenous Extract Matter,	51.39	102.78	647.51	63	
	100.00	2,000.00	1,132.32	–	

DRY CORN FODDER (Stover).

[From Experiment Station.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	15.40	308.00	–	–	
Dry Matter,	84.60	1,692.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	4.22	84.40	–	–	
" Cellulose,	20.93	418.60	301.39	72	1 : 9.3
" Fat,	2.63	52.60	39.45	75	
" Protein (Nitrogenous Matter),	9.17	183.40	133.88	73	
Non-nitrogenous Extract Matter,	63.05	1,261.00	844.87	67	
	100.00	2,000.00	1,319.59	–	

CORN ENSILAGE.

[From the Silos of the Experiment Station.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	71.60	1,432.00	–	–	
Dry Matter,	28.40	568.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	3.32	66.40	–	–	
" Cellulose,	18.52	370.40	266.69	72	1 : 11.9
" Fat,	6.07	121.40	91.05	75	
" Protein (Nitrogenous Matter),	7.78	155.60	113.59	73	
Non-nitrogenous Extract Matter,	64.31	1,286.20	861.75	67	
	100.00	2,000.00	1,333.08	–	

CARROTS.

[Raised at the Experiment Station, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	90.02	1,800.40	–		
Dry Matter,	9.98	199.60	–		
	100.00	2,000.00	–		
Analysis of Dry Matter.					
Crude Ash,	11.21	224.20	–		
" Cellulose,	10.76	215.20	215.20	100	1 : 9.24
" Fat,	1.89	37.80	37.80		
" Protein (Nitrogenous Matter),	8.90	178.00	178.00		
Non-nitrogenous Extract Matter,	67.24	1,344.80	1,344.80		
	100.00	2,000.00	1,775.80		

The average amount of dry matter in well grown carrots is usually stated (E. Wolff) to be 15 per cent. of the weight of the fresh root; in *our* case it varied from *9 to 12* per cent., according to the size of the root tested. Large specimens of roots contain frequently a smaller amount of dry vegetable matter than smaller ones equally matured. Cultivation, manuring, season and time of seeding, aside from fitness of the soil, affect seriously the general character of the root crops. In our case, soil and state of fertilization were favorable, — frequent rains towards the close of the summer season had favored apparently in an exceptional degree the growth of the leaves at the expense of a timely maturing of the roots.

Analysis of Carrots with reference to Fertilizing Constituents.

	Per cent.
Moisture at 100° C.,	90.02
Ferric oxide,	0.01
Phosphoric acid (6 cents per pound),	0.10
Magnesium oxide,	0.02
Calcium oxide,	0.07
Potassium oxide (4¼ cents per pound),	0.54
Sodium oxide,	0.11
Nitrogen (17 cents per pound),	0.14
Insoluble matter,	0.01
Valuation per 2,000 pounds,	$1 06

CORN MEAL.

[Amherst, Mass.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.62	252.40	–	–	
Dry Matter,	87.38	1,747.60	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.56	31.20	–	–	
" Cellulose,	2.66	53.20	18.09	34	1 : 8.76
" Fat,	4.27	85.40	64.90	76	
" Protein (Nitrogenous Matter,	11.43	228.60	194.31	85	
Non-nitrogenous Extract Matter,	80.08	1,601.60	1,505.50	94	
	100.00	2,000.00	1,782.80	–	

WHEAT BRAN.

[Amherst, Mass.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.87	217.40	–	–	
Dry Matter,	89.13	1,782.60	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	5.90	118.00	–	–	
" Cellulose,	8.27	165.40	33.08	20	1 : 3.47
" Fat,	4.40	88.00	70.40	80	
" Protein (Nitrogenous Matter,	19.63	392.60	345.53	88	
Non-nitrogenous Extract Matter,	61.80	1,236.00	988.80	80	
	100.00	2,000.00	1,437.81	–	

RYE BRAN (Middlings).

[Amherst Mills.]

74.63 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.)	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.54	250.80	–	–	
Dry Matter,	87.46	1,749.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	4.02	80.40	–	–	
" Cellulose,	3.70	74.00	6.66	9.0	1 : 7.23
" Fat,	5.61	112.20	64.52	57.5	
" Protein (Nitrogenous Matter),	13.15	263.00	173.58	66.0	
Non-nitrogenous Extract Matter,	73.52	1,470.40	1,095.45	74.5	
	100.00	2,000.00	1,340.21	–	

Analysis of Rye Bran with Reference to Fertilizing Constituents.

One hundred parts of air-dried Bran contained: —

	Per cent.
Moisture at 100° C.,	12.54
Phosphoric acid (6 cents per pound),	1.26
Magnesium oxide,	0.32
Calcium oxide,	0.09
Ferric oxide,	0.02
Potassium oxide, (4½ cents per pound),	0.81
Sodium oxide,	0.03
Nitrogen (17 cents per pound),	1.84
Insoluble matter,	0.17
Valuation per 2,000 pounds,	$8 46

CHICAGO GLUTEN MEAL.

96.81 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.83	176.60	–	–	
Dry Matter,	91.17	1,823,40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	0.73	14.60	–	–	
" Cellulose,	0.79	15.80	5.37	34	1 : 2.67
" Fat,	8.46	169.20	128.59	76	
" Protein (Nitrogenous Matter),	31.43	628.60	534.31	85	
Non-nitrogenous Extract Matter,	58.59	1,171.80	1,101.49	94	
	100.00	2,000.00	1,769.76	–	

The material is sold at Springfield, Mass., at $23.20 per ton.

Analysis of Gluten Meal with reference to Fertilizing Constituents.

	Per cent.
Moisture at 100° C.,	8.83
Phosphoric acid (6 cents per pound),	0.30
Ferric oxide,	0.05
Magnesium oxide,	0.03
Calcium oxide,	0.03
Potassium oxide (4½ cents per pound),	0.03
Sodium oxide,	0.02
Nitrogen (17 cents per pound),	4.62
Valuation per 2,000 pounds,	$16 15

2. Feeding Experiments with Milch Cows.

The experiments were chiefly instituted for the purpose of comparing the feeding effect of a good English hay with that of some reputed green fodders. The green crops used in this connection consisted of a mixed crop of oats and vetch, of southern cow-pea and of serradella. Some details regarding the mode of cultivation and the general character of these fodder plants will be found farther on in this report, under the heading "Field Experiments."

The feeding of the various green fodders began at the time of their blooming; they were fed in succession as stated above, for they began to bloom in the order mentioned. The feeding of vetch and oats ceased when the oats turned yellow; that of the cow-pea and serradella terminated with the exhaustion of the supply from the first cut.

The customary rules for the management of feeding experiments, regarding the changes in feed, etc., were followed in the same manner as pointed out on previous occasions.

Five cows served in the experiment. Two cows, Ida and Lizzie, were fed during the entire trial with a daily ration, consisting of

Corn Meal, ...	3¼ pounds (2 quarts.)
Wheat Bran, ...	3¼ pounds (4 quarts.)
English Hay, ...	from 20 to 25 pounds.

The amount of hay left over was each day weighed back; the printed detailed record below gives the average daily consumption for each feeding period. Three cows, Eva, Minnie and May, received periodically the same diet as the first mentioned two. This daily diet was however replaced at stated times by the following one:

Corn Meal, ...	3¼ pounds.
Wheat Bran, ...	3¼ pounds.
English Hay, ...	5 pounds.

and as much of either green vetch and oats or green southern cow-pea or green serradella as the animals on trial would consume.

The average of the daily consumption in each feeding period is stated in the subsequent record of the experiment. One-fourth (five pounds) of the adopted full daily hay ration has been retained in our green fodder diet for the purpose of preventing disorders in the digestion of a liberal quantity of green fodder.

The green fodder diet has produced in two cases, cow pea and serradella, a decided temporary increase in the quantity of milk when compared with the English hay diet. The substitution of three-fourths of the full hay ration by cow pea and serradella has given also satisfactory results as far as the quality of the milk, the net cost of feed and the general condition of the animals on trial are concerned. The serradella leads as a rule.

The substitution of hay by the mixed crop of vetch and oats has not shown in some directions as decisive advantages. This circumstance may find its explanation in the future by the fact that our mixed crop, vetch and oats, consisted of one-tenth in dry weight of vetch to nine-tenths of that of oats; it ought to contain from one to two or equal weights. The vetches rank among the better class of fodder crops furnished by the great and important family of leguminous plants. Green vetch when fed with green oats is more relished by cattle than when fed alone.

The cost of green fodder is based on that of hay, $15.00 per ton, allowing two tons of hay, with 15 per cent. of moisture, as the average produce of English hay per acre. This mode of valuation has been adopted on account of the entire absence of market prices as far as green vetch, cow pea and serradella are concerned. These crops, as a rule, rank higher in the scale of an agricultural valuation than the meadow grass.

Produce Per Acre of Green Crops raised on the Station Grounds.

6.80 tons of grass at 75 per cent. moisture, equals 2 tons at 15 per cent. moisture.

10.89 tons of vetch and oats at 73.36 per cent. moisture, equals 1.8 tons at 15 per cent. moisture.

9.56 tons of cow pea at 80.62 per cent. moisture, equals 2.4 tons at 15 per cent. moisture.

9.50 tons of serradella at 80.14 per cent. moisture, equals 2.2 tons at 15 per cent. moisture.

Valuation Per Ton of the Articles of Fodder used.

Wheat Bran,	$21.00	Green Cow Pea,	$3.14
Corn Meal,	21.00	Green Serradella,	3.16
Hay,	15.00	Green Grass,	4.41
Green Vetch and Oats,	2.75		

A few subsequent pages contain a more detailed statement of our actual observations.

FEEDING RECORD.

LIZZIE: FIVE YEARS; NATIVE; LAST CALF, FEB. 1, 1887.

FEEDING PERIODS.	FEED CONSUMED (POUNDS) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (in pounds.)	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Average weight of animal during each feeding period.
	Wheat Bran.	Corn Meal.	Hay.					
1887.								
1. June 2 to Aug. 23, ...	3.25	3.25	19.89	23.46	12.73	1.84	1:8.54	986.45
2. Sept. 1 to Oct. 25, ...	3.25	3.25	24.44	27.52	9.59	2.86	1:8.72	1,011.56

IDA: SEVEN YEARS; GRADE, DURHAM; LAST CALF, FEB. 3, 1887.

1887.								
1. June 2 to Aug. 23, ...	3.25	3.25	19.87	23.44	7.54	3.10	1:8.53	984.58
2. Sept. 1 to Oct. 25, ...	3.25	3.25	23.77	26.92	4.89	5.50	1:9.27	1,009.06

Total Cost of Feed per Quart of Milk.

(LIZZIE.)

	Total quantity of Milk produced during entire period.	Average daily yield of Milk for period.	Total amount of Wheat Bran consumed during period.	Total amount of Corn Meal consumed during period.	Total amount of Hay consumed during period.	Total cost of Feed consumed during period.	Average cost of Feed for production of one quart of Milk for period.
1887.	Qts.	Qts.	Lbs.	Lbs.	Lbs.		Cents.
1. June 2 to Aug. 23,	1,056.50	12.73	269.75	269.75	1,651.25	$18 04	1.70
2. Sept. 1 to Oct. 25,	527 75	9.59	178.75	178.75	1,344.00	13 84	2.62

(IDA.)

1887.	Qts.	Qts.	Lbs.	Lbs.	Lbs.		Cents.
1. June 2 to Aug. 23,	625.75	7.54	269.75	269.75	1,650.30	$18 04	2.88
2. Sept. 1 to Oct. 25,	269.25	4.89	178.75	178.75	1,307 75	13 57	5.04

Manurial Value of Feed.

(LIZZIE.)

FEEDING PERIODS.	Total cost of Feed consumed during period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting 20 per cent. taken by the Milk.	Net cost of Feed for the production of Milk during period.	Net cost of Feed for the production of one quart of Milk.	Weight of animal at close of period.
1887.					Cents.	Lbs.
1. June 2 to Aug. 23, ...	$18 04	$8 40	$6 72	$11 32	1.07	980.00
2. Sept. 1 to Oct. 25, ...	13 84	6 42	5 14	8 70	1.64	1,015.00
Total, ...	$31 88	$14 82	$11 86	$20 02	–	–

(IDA.)

1887.					Cents.	Lbs.
1. June 2 to Aug. 23, ...	$18 04	$8 40	$6 72	$11 32	1.80	980.00
2. Sept. 1 to Oct. 25, ...	13 57	6 30	5 04	8 53	3.17	1,030.00
Total, ...	$31 61	$14 70	$11 76	$19 85	–	–

FEEDING RECORD.

EVA: Age Seven Years; Grade, Jersey, Last Calf, Jan. 20, 1887.

FEEDING PERIODS.	Feed Consumed (pounds) per day.						Amount of dry vegetable matter contained in the daily fodder consumed (in pounds.)	Quarts of Milk produced per day.	Pounds of dry matter per quart of Milk.	Nutritive Ratio.	Average weight of animal during each Feeding Period.
	Wheat Bran.	Corn Meal.	Hay.	Vetch and Oats.	Cow Pea.	Serradella.					
1887.											
1. June 2 to July 7, ...	3.25	3.25	19.88	–	–	–	23.45	11.64	2.01	1 : 8.54	937.70
2. July 12 to 26, ...	3.25	3.25	5.00	59.15	–	–	25.93	10.20	2.54	1 : 6.94	902.50
3. Aug. 1 to 7, ...	3.25	3.25	19.82	–	–	–	23.39	9.10	2.57	1 : 8.51	917.50
4. Aug. 14 to Sept. 1, ...	3.25	3.25	5.00	–	97.37	–	28.94	10.71	2.70	1 : 9.01	875.83
5. Sept. 6 to 27, ...	3.25	3.25	5.22	–	–	97.12	29.52	9.57	3.08	1 : 5.38	933.12
6. Oct. 3 to 25, ...	3.25	3.25	23.52	–	–	–	26.69	7.73	3.45	1 : 8.67	938.12

FEEDING RECORD — Continued.

MINNIE: AGE, SEVEN YEARS; GRADE, AYRSHIRE; LAST CALF, MAY 3, 1887.

FEEDING PERIODS.	FEED CONSUMED (POUNDS) PER DAY.						Amount of dry vegetable matter contained in the daily fodder consumed (in pounds.)	Quarts of Milk produced per day.	Pounds of dry matter per quart of Milk.	Nutritive Ratio.	Average weight of animal during each Feeding Period.
	Wheat Bran.	Corn Meal.	Hay.	Vetch and Oats.	Cow Pea.	Serradella.					
1887.											
1. June 2 to July 7, ...	3.25	3.25	19.97	–	–	–	23.53	15.73	1.49	1:8.51	905.00
2. July 12 to 26, ...	3.25	3.25	5.00	67.80	–	–	28.24	14.53	1.94	1:6.94	895.83
3. Aug. 1 to 7, ...	3.25	3.25	20.14	–	–	–	23.64	12.60	1.87	1:8.57	990.00
4. Aug. 14 to Sept. 1, ...	3.25	3.25	5.00	–	97.37	–	28.94	15.09	1.92	1:9.01	896.66
5. Sept. 6 to 27, ...	3.25	3.25	5.22	–	–	98.20	29.74	14.81	2.01	1:5.36	947.50
6. Oct. 3 to 25, ...	3.25	3.25	24.42	–	–	–	27.50	11.60	2.57	1:8.72	958.12

FEEDING RECORD — Concluded.

MAY: AGE, SIX YEARS; GRADE, JERSEY; LAST CALF, JUNE 6, 1887.

FEEDING PERIODS.	FEED CONSUMED (POUNDS) PER DAY.						Amount of dry vegetable matter contained in the daily fodder consumed (in pounds.)	Quarts of Milk produced per day.	Pounds of dry matter per quart of Milk.	Nutritive Ratio.	Average weight of animal during each Feeding Period.
	Wheat Bran.	Corn Meal.	Hay.	Vetch and Oats.	Cow Pea.	Serradella.					
1887.											
1. June 19 to July 7, ...	3.25	3.25	19.82	–	–	–	23.39	13.90	1.68	1 : 8.51	815.50
2. July 12 to 26, ...	3.25	3.25	5.00	64.23	–	–	27.28	12.90	2.11	1 : 6.94	801.25
3. Aug. 1 to 7, ...	3.25	3.25	20.04	–	–	–	23.58	11.78	2.00	1 : 8.53	795.00
4. Aug. 14 to Sept. 1, ...	3.25	3.25	5.00	–	97.37	–	28.94	12.10	2.39	1 : 9.01	777.50
5. Sept. 6, to 27, ...	3.25	3.25	5.22	–	–	97.71	29.64	11.85	2.50	1 : 5.45	822.50
6. Oct. 3, to 25, ...	3.25	3.25	24.18	–	–	–	27.28	9.93	2.75	1 : 8.70	849.37

Total Cost of Feed per Quart of Milk.

(Eva.)

1887.	Total quantity of Milk Produced during entire Period.	Average daily yield of Milk for Period.	Total amount of Wheat Bran Consumed during Period.	Total amount of Corn Meal Consumed during Period.	Total amount of Hay Consumed during Period.	Total amount of Vetch and Oats Consumed during period.	Total amount of Cow Pea consumed during Period.	Total amount of Serradella Consumed during Period.	Total cost of Feed Consumed during Period.	Average cost of Feed for Production of one Quart of Milk for Period.
	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. June 2 to July 7, ...	419.00	11.64	117.00	117.00	716.00	–	–	–	$7 83	1.39
2. July 12 to 26, ...	153.00	10.20	48.75	48.75	75.00	887.25	–	–	2 81	1.84
3. Aug. 1 to 7, ...	63.75	9.10	22.75	22.75	138.75	–	–	–	1 52	2.38
4. Aug. 14 to Sept. 1, ...	203.50	10.71	61.75	61.75	95.00	–	1,850.00	–	4 91	2.41
5. Sept. 6 to 27, ...	210.50	9.57	71.50	71.50	115.00	–	–	2,136.75	5 74	2.25
6. Oct. 3 to 25, ...	178.25	7.73	74.75	74.75	521.00	–	–	–	5 46	3.06

Total Cost of Feed per Quart of Milk — Continued.

(MINNIE.)

	Total quantity of Milk Produced during entire Period.	Average daily yield of Milk for Period.	Total amount of Wheat Bran Consumed during Period.	Total amount of Corn Meal Consumed during Period.	Total amount of Hay Consumed during Period.	Total amount of Vetch and Oats Consumed during Period.	Total amount of Cow Pea Consumed during Period.	Total amount of Serradella Consumed during Period.	Total cost of Feed Consumed during Period.	Average cost of Feed for Production of one Quart of Milk for period.
1887.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. June 2 to July 7,	566.25	15.73	117.00	117.00	719.00	–	–	–	$7 85	1.38
2. July 12 to 26,	218.00	14.53	48.75	48.75	75.00	1,017.00	–	–	2 99	1.37
3. Aug. 1 to 7,	88.25	12.60	22.75	22.75	141.00	–	–	–	1 54	1.74
4. Aug. 14 to Sept. 1,	286.70	15.09	61.75	61.75	95.00	–	1,850.00	–	4 91	1.72
5. Sept. 6 to 27,	326.00	14.81	71.50	71.50	115.00	–	–	2,160.50	5 78	1.77
6. Oct. 3 to 25,	267.00	11.60	74.75	74.75	561.75	–	–	–	5 77	2.16

Total Cost of Feed per Quart of Milk — Concluded.

(MAY.)

	Total quantity of Milk Produced during entire Period.	Average daily yield of Milk for Period.	Total amount of Wheat Bran Consumed during Period.	Total amount of Corn Meal Consumed during Period.	Total amount of Hay Consumed during Period.	Total amount of Vetch and Oats Consumed during Period.	Total amount of Cow Pea Consumed during Period.	Total amount of Serradella Consumed during Period.	Total cost of Feed Consumed during Period.	Average cost of Feed for Production of one Quart of Milk for Period.
1887.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Cents.
1. June 19 to July 7, ...	264.25	13.90	61.75	61.75	376.50	–	–	–	$4 12	1.55
2. July 12 to 26, ...	193.50	12.90	48.75	48.75	75.00	963.50	–	–	2 92	1.51
3. Aug. 1 to 7, ...	78.25	11.78	22.75	22.75	140.25	–	–	–	1 54	1.96
4. Aug. 14 to Sept 1, ...	230.00	12.10	61.75	61.75	95.00	–	1,850.00	–	4 91	2.13
5. Sept. 6 to 27, ...	260.75	11.85	71.50	71.50	115.00	–	–	2,149.50	5 76	2.21
6. Oct. 3 to 25, ...	267.00	9.93	74.75	74.75	556.25	–	–	–	5 73	2.15

Valuation of Essential Fertilizing Constituents contained in the various Articles of Fodder Used.

Nitrogen, 17 cents per pound; Phosphoric acid, 6 cents; Potassium oxide, 4¼ cents.

(*Per cent.*)

	Wheat Bran.	Corn Meal.	Hay.	Green Vetch and Oats.	Green Cow Pea.	Green Serradella.
Nitrogen, ...	2.80	1.66	1.41	0.451	0.274	0.379
Phosphoric acid, . . .	2.36	0.77	0.41	0.100	0.098	0.124
Potassium oxide, . . .	1.36	0.45	1.84	0.838	0.306	0.398
Valuation per 2,000 pounds,	$13 51	$6 94	$6 84	$2 36	$1 31	$1 77

Manurial Value of Feed.

(Eva.)

FEEDING PERIODS.	Total Cost of Feed Consumed during Period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting 20 per cent. taken by the Milk.	Net Cost of Feed for the production of Milk during Period.	Net Cost of Feed for the production of one Quart of Milk.	Weight of animal at close of Period.
1887.					Cents.	Lbs.
1. June 2 to July 7,	$7 83	$3 64	$2 91	$4 92	1.17	956.00
2. July 12 to 26, .	2 81	1 80	1 44	1 37	0.89	922.50
3. Aug. 1 to 7, .	1 52	71	57	95	1.49	917.50
4. Aug. 14 to Sept. 1,	4 91	2 16	1 73	3 18	1.56	887.50
5. Sept. 6 to 27, .	5 74	3 03	2 42	3 32	1.57	995.00
6. Oct. 3 to 25, .	5 46	2 55	2 04	3 42	1.91	957.50
Total, . .	$28 27	$13 89	$11 11	$17 16	–	–

Manurial Value of Feed—Continued.

(MINNIE.)

FEEDING PERIODS.	Total Cost of Feed Consumed during Period.	Value of Fertilizing Constituents contained in the Feed.	Manurial Value of the Feed after deducting 20 per cent. taken by the Milk.	Net Cost of Feed for the production of Milk during Period.	Net Cost of Feed for the production of one Quart of Milk.	Weight of animal at close of Period.
1887.					Cents.	Lbs.
1. June 2 to July 7,	$7 85	$3 65	$2 92	$4 93	0.87	935.00
2. July 12 to 26,	2 99	1 96	1 57	1 42	0.66	930.00
3. Aug. 1 to 7,	1 54	71	57	97	1.09	990.00
4. Aug. 14 to Sept. 1,	4 91	2 16	1 73	3 18	1.19	915.00
5. Sept. 6 to 27,	5 78	3 05	2 44	3 34	1.02	965.00
6. Oct. 3 to 25,	5 77	2 68	2 15	3 62	1.35	992.50
Total,	$28 84	$14 21	$11 38	$17 46	–	–

(MAY.)

					Cents.	Lbs.
1887.						
1. June 19 to July 7,	$4 12	$1 92	$1 54	$2 58	0.98	831.50
2. July 12 to 26,	2 92	1 89	1 51	1 41	0.73	822.50
3. Aug. 1 to 7,	1 54	71	57	97	1.24	795.00
4. Aug. 14 to Sept. 1,	4 91	2 16	1 73	3 18	1.38	800.00
5. Sept. 6 to 27,	5 76	3 05	2 44	3 32	1.28	857.50
6. Oct. 3 to 25,	5 73	2 66	2 13	3 60	1.34	832.50
Total,	$23 98	$12 39	$9 92	$14 06	–	–

Analyses of Milk.

LIZZIE.

(Per cent.)

	June 23.	July 6.	July 27.	Aug. 8.	Sept. 23.	Oct. 11.	Oct. 25.
Water, . . .	–	87.38	–	–	86.84	–	85.91
Solids, . . .	–	12.62	–	–	13.16	–	14.09
Fat (in solids), . .	–	4.12	–	–	4.20	–	5.25

IDA.

Water, . . .	–	86.87	–	–	86.82	–	87.18
Solids, . . .	–	13.13	–	–	13.18	–	12.82
Fat (in solids), . .	–	4.75	–	–	4.25	–	4.70

EVA.

Water, . . .	–	85.05	85.59	85.50	85.77	84.73	83.99
Solids, . . .	–	14.95	14.41	14.50	14.23	15.27	16.01
Fat (in solids), . .	–	5.53	5.39	5.08	4.76	5.46	5.93

MINNIE.

Water, . . .	–	87.25	89.06	87.97	87.23	87.40	87.15
Solids, . . .	–	12.75	10.94	12.03	12.77	12.60	12.85
Fat (in solids), . .	–	4.09	2.75	3.35	4.09	3.74	4.04

MAY.

Water, . . .	86.46	87.00	87.30	88.23	87.13	87.35	86.52
Solids, . . .	13.54	13.00	12.70	11.77	12.87	12.65	13.48
Fat (in solids), . .	3.82	3.76	3.46	3.13	3.76	3.71	4.34

Analyses of Fodder Articles used in Experiment 2.

VETCH AND OATS.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	73.36	1,467.20	–	–	
Dry Matter,	26.64	532.80	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	12.37	247.40	–	–	
" Cellulose,	34.20	684.00	–	–	
" Fat,	2.74	54.80	27.40	50	1 : 6.85
" Protein (Nitrogenous Matter),	10.59	211.80	127.08	60	
Non-nitrogenous Extract Matter,	40.10	802.00	802.00	100	
	100.00	2,000.00	956.48	–	

COW PEA.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	80.62	1,612.40	–	–	
Dry Matter,	19.38	387.60	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	5.97	119.40	–	–	
" Cellulose,	23.02	60.40	216.39	47	
" Fat,	1.81	36.20	21.36	59	1 : 11.71
" Protein (Nitrogenous Matter),	8.58	171.60	102.96	60	
Non-nitrogenous Extract Matter,	60.62	1,212.40	936.56	69	
	100.00	2,000.00	1,277.27	–	

SERRADELLA.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture, at 100° C.,	80.14	1,602.80	–	–	
Dry Matter,	19.86	397.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	11.53	230.60	–	–	
" Cellulose,	38.76	775.20	–	–	
" Fat,	2.09	41.80	25.08	60	1:5.03
" Protein (Nitrogenous Matter),	12.17	243.40	153.34	63	
Non-nitrogenous Extract Matter,	35.45	709.00	709.00	100	
	100.00	2,000.00	887.42	–	

Analyses of Green Crops with reference to Fertilizing Constituents.

	Per Cent.		
	Vetch and Oats.	Cow Pea.	Serradella.
Moisture at 100° C.,	73.36	80.62	80.140
Phosphoric acid,	.100	.098	.124
Potassium oxide,	.838	.306	.398
Sodium oxide,	.033	.063	.098
Calcium oxide,	.092	.300	.472
Magnesium oxide,	.031	.099	.067
Ferric oxide,	.012	.016	.021
Nitrogen,	.451	.274	.379
Insoluble matter,	.352	.077	.157

WHEAT BRAN.

73.36 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	11.14	222.80	–	–	
Dry Matter,	88.86	1,777.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.59	131.80	–	–	
" Cellulose,	12.80	256.00	51.20	20	
" Fat,	6.00	120.00	96.00	80	1 : 3.85
" Protein (Nitrogenous Matter),	17.72	354.40	311.87	88	
Non-nitrogenous Extract Matter,	56.89	1,137.80	910.24	80	
	100.00	2,000.00	1,369.31	–	

CORN MEAL.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	13.08	261.60	–	–	
Dry Matter,	86.92	1,738.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.66	33.20	–	–	
" Cellulose,	3.49	69.80	23.73	34	
" Fat,	4.97	99.40	75.54	76	1 : 9.66
" Protein (Nitrogenous Matter),	10.39	207.80	176.63	85	
Non-nitrogenous Extract Matter,	79.49	1,589.80	1,494.41	94	
	100.00	2,000.00	1,770.41	–	

HAY.

[From Experiment Station, 1887.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.78	215.60	–	–	
Dry Matter,	89.22	1,784.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.11	142.20	–	–	
" Cellulose,	35.55	711.00	412.38	58	
" Fat,	2.63	52.60	24.19	46	
" Protein (Nitrogenous Matter),	8.75	175.00	99.75	57	
Non-nitrogenous Extract Matter,	45.96	919.20	579.10	63	
	100.00	2,000.00	1,115.42	–	1:10.54

Milk and Creamery Record from November 1, 1886, to October 31, 1887.

	Quarts of Milk Produced.	Spaces of Cream from Milk.	Price allowed per Space.	Amount Received from Creamery.
1886.				
November 1 to 30,	1,178¼	380	4 cents.	$15 20
December 1 to 31,	1,153¼	414	4 "	16 56
1887.				
January 1 to 31,	1,002	416	3⅞ "	16 12
February 1 to 28,	2,191	1,007	3¾ "	37 76
March 1 to 31,	2,525¼	1,044	3¾ "	39 15
April 1 to 30,	2,296½	834	3⅝ "	30 23
May 1 to 31,	1,735½	928	3⅜ "	31 32
June 1 to 30,	1,931	968	3 "	29 04
July 1 to 31,	1,852¾	855	3⅛ "	26 72
August 1 to 31,	1,869	990	3½ "	34 65
September 1 to 30,	1,920¼	1,002	3½ "	35 07
October 1 to 31,	1,662½	930	3¾ "	34 87
	21,317½	9,768	–	$346 69

November,	1886.	6.60 spaces of cream make 1 lb. butter, equal to 26.40 cents per pound.
December,	1887.	6.60 spaces of cream make 1 lb. butter, equal to 26.40 cents per pound.
January,	"	6.60 spaces of cream make 1 lb. butter, equal to 25.57 cents per pound.
February,	"	6.55 spaces of cream make 1 lb. butter, equal to 24.56 cents per pound.
March,	"	6.33 spaces of cream make 1 lb. butter, equal to 23.76 cents per pound.
April,	"	6.37 spaces of cream make 1 lb. butter, equal to 23.09 cents per pound.
May,	"	6.30 spaces of cream make 1 lb. butter, equal to 21.30 cents per pound.
June,	"	6.47 spaces of cream make 1 lb. butter, equal to 19.47 cents per pound.
July,	"	6.31 spaces of cream make 1 lb. butter, equal to 19.73 cents per pound.
August,	"	6.44 spaces of cream make 1 lb. butter, equal to 22.55 cents per pound.
September,	"	6.55 spaces of cream make 1 lb. butter, equal to 22.98 cents per pound.
October,	"	6.55 spaces of cream make 1 lb. butter, equal to 24.58 cents per pound.

During the first three months — November, December and January — the milk was furnished by three cows; and during the remainder of the time by six cows.

The total amount of milk set was 21,317½ quarts; the total receipts for cream produced were $346.69, or, on an average, 1.63 cents per quart of milk produced.

3. Feeding Experiments with Pigs.

The observations recorded below are a continuation of feeding experiments with pigs, described in our Second and Third Annual Reports. The first of these experiments (see, for details, Second Annual Report, page 68) was instituted for the purpose of comparing the feeding effects of *equal measures* of creamery buttermilk — Amherst creamery — and of skim-milk from the Station, adding in both instances to the daily diet a corresponding amount of corn meal. The daily ration of corn meal was from time to time increased, independent of the amount of milk fed at the time, during the progress of the growth of the animals on trial. The results of this experiment showed practically no difference in regard to the amount of dressed pork produced in either case.

Repeated examinations of the two kinds of milk used in the trial had proved that the skim-milk contained on an average one-fifth, or twenty per cent., more solid matter of a similar character than the creamery buttermilk at our disposal.

This excess of solids in the skim-milk, judging from our results, seemed to be wasted in our mode of feeding; for 714 pounds of corn meal and 982 gallons of skim-mik (with 10 per cent. of solids) had produced 510 pounds of dressed pork, whilst 718 pounds of corn meal and 985 gallons of creamery buttermilk (with 8 per cent. of solids) had yielded, under otherwise corresponding circumstances, 515 pounds of dressed pork, as the total amount from three pigs on each side.

To account, if possible, for the less satisfactory returns of the skim-milk diet, as compared with that of the creamery buttermilk, the second feeding experiment was planned (see, for details, Third Annual Report, page 23). It was decided to calculate the amount of corn meal to be fed in the new experiment with reference *to an equal amount* of *solids* in *both kinds of milk* and *not* with reference to *any equal measure* of both kinds.

The average result of this trial seemed to account quite satisfactorily for the above-stated difference in solids of both

kinds of milk; for 2,250 pounds of corn meal fed with 1,533 gallons of skim-milk had produced 990½ pounds of dressed pork, whilst 2,211 pounds of corn meal fed with 1,899 gallons of creamery buttermilk had yielded, under otherwise corresponding circumstances, 889½ pounds of dressed pork, as the total returns from six pigs on each side. It was stated on that occasion, that, in our opinion, *a more judicious distribution* of an *increased proportion* of *corn meal*, in case of the skim-milk diet had evidently rendered the latter, pound for pound, more efficient during the second experiment, as compared with the first.

Having adopted the same local market prices of the three articles, which served in the daily diet during both experiments,— corn meal per ton, $22.50; skim-milk, 1.8 cents per gallon; buttermilk, 1.37 cents per gallon, — it was found that the cost of feed consumed, per pound of dressed pork produced, in the first experiment, amounted in case of the creamery buttermilk diet to 4.6 cents, in case of the skim-milk diet to 5.8 cents; whilst in the second experiment it amounted, in case of the former to 4.2 cents, and in case of the latter to 4.85 cents. In calculating the cost of the food consumed in each case on the *above-stated market prices*, the creamery buttermilk had proved the cheaper article; the *higher nutritive value* of the more concentrated *skim-milk* from our dairy had been more than offset by the *lower market price* of the *creamery buttermilk*. The adoption of *an equal market price per gallon* of *skim-milk and of creamery buttermilk*, 1.37 cents per gallon, would have caused a reduction in the above-stated cost of feed, per pound of dressed pork, of from .65 to .75 cents in favor of the skim-milk.

Before proceeding with the description of the five succeeding experiments, it seems advisable to offer a few explanatory remarks regarding the standpoint assumed in the planning and management of the work here under discussion. In the published detailed record of the second feeding experiment (see Third Annual Report), it may be noticed that the character of the daily diet was changed from time to time by adding a larger proportion of corn meal to a given amount of skim-milk, or buttermilk. The quantity of feed offered daily to the ani-

mals on trial was controlled by their individual appetite, — beginning with eight and twelve ounces of meal to four quarts of milk and closing with a daily ration consisting, in case of one lot of animals, of ninety-one ounces of corn meal and twelve quarts of buttermilk per head, and in case of the other, of one hundred and eight ounces of corn meal to seven quarts of skim-milk. The changes regarding the quantity of the daily supply of feed were, for obvious reasons, gradual and depending on the appetite of each animal. The alterations regarding the character of the daily feed — i. e., the changes in the relative proportion of meal and milk — were made with reference to the stage of growth of the animals on trial. The proportions between meal and milk were changed from four to five times. These changes consisted in a periodical increase of meal for a given amount of milk; they were made for the purpose of increasing the amount of non-nitrogenous fodder constituents in the daily diet during the later stages of growth. This course of preparing the daily feed was adopted to secure, whenever desired, a definite change in the relative proportion of its digestible nitrogenous and non-nitrogenous food constituents. As both kinds of milk used in the experiment contained the nitrogenous food constituents in a much larger proportion (1 :1.8,—1 :1.9) than the corn meal (1 :8.76), an increase in the quantity of the latter rendered it possible to regulate, within certain limits, the character (nutritive ratio) of the daily diet, with reference to a desired proportion of both groups of essential food constituents. The experiment (II.) began with a daily diet, consisting of skim-milk and corn meal, which contained one part of digestible nitrogenous food constituents to 2 :7 parts of digestible non-nitrogenous food constituents; this proportion was subsequently altered by an increase in corn meal to 1 :3.1, later on to 1 :3.9, and closed with 1 :5. The animals which served in this particular case varied in weight from 17 to 19 pounds at the beginning of the experiment. The first stated ration was fed until the animals had reached a weight of from 45 to 50 pounds; the second until they had reached from 90 to 100 pounds, the third until 135 to 145 pounds, and the fourth subsequently to the end of the trial. The final summing up of the results of that experi-

ment showed, when including the entire number of pigs on trial (twelve), that 3.39 pounds of dry matter contained in the feed consumed had yielded one pound of dressed pork. In two instances (of the buttermilk diet) from 3.47 to 3.48 pounds of dry matter of the feed had been consumed for one pound of dressed pork obtained; while in two other instances (of the skim-milk diet) from 2.97 to 3.27 pounds of dry matter of the feed had sufficed for the production of the same weight of dressed pork (one pound).

As it seemed of interest to learn whether the particular course pursued in the previously described experiments of feeding skim-milk from the home dairy with corn meal could be improved on, and, if so, in what direction, the three subsequently described new feeding experiments were instituted. *The principal aim of these new experiments was to ascertain whether a daily diet for pigs, of which skim-milk and corn meal formed a material portion, would secure better pecuniary returns, in case an exceptionally large proportion of digestible nitrogenous food constituents was fed during the entire experiment.* Gluten meal and wheat bran were chosen for various reasons to serve in making up the feed to meet this requirement as soon as our milk supply became exhausted. A short abstract of the results obtained in this connection may be found upon a few succeeding pages. Although not less than four animals have served in each of these five new experiments, our present communication will be confined to a *detailed* record of but two animals in each case, with the exception of the last experiment (VII.).

Third Feeding Experiment (A, B).

Four animals of a mixed breed were selected for the work: their respective weights varied from 40 to 59 pounds. The daily diet during the first three months consisted exclusively of skim-milk from the Station and of corn meal; during the remainder of the time (three and a half months) a mixture of equal weights of wheat bran and gluten meal was added, to assist in maintaining the desired close relation between the proportion of digestible nitrogenous and non-nitrogenous food constituents in the daily food. The relation between these two important groups of food constituents

was materially the same during the entire experiment. It consisted of one part of nitrogenous food constituents to from 3.27 to 3.76 parts of non-nitrogenous constituents. From four and one-half to five ounces of corn meal were added to every quart of skim-milk needed, to meet the wants of the animal. This composition of the feed was retained until the quantity called for per head had reached eight quarts of skim-milk and forty ounces of corn meal per day. At this stage of the experiment the mixture of equal weights of wheat bran and gluten meal was added to the daily fodder ration; beginning with sixteen ounces per head, and closing up with twenty-five ounces. The exact amount required per day was governed by the appetite of the animal; the mixture served to meet the increasing demand of the various animals on trial. It is a good rule to increase the daily fodder rations only when called for, and always gradually.

The subsequent detailed record of our results shows that the cost of feed consumed per pound of dressed weight produced varied from 6.2 cents to 6.6 cents, while from 4.10 to 4.18 pounds of dry matter contained in the feed consumed had yielded one pound of dressed pork. The live weights gained during the experiment amounted to 246.5 and 206.5 pounds.

[A.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at close of Period.	Gain in Weight per day during Period.
1885.								lb. oz.
April 1 to May 11,	73.5	257.0	–	–	1:3.29	40.0	84.8	1 1
May 12 to June 3,	57.5	184.0	–	–	1:3.39	84.8	110.5	1 2
June 4 to June 29,	49.0	208.0	8.9	8.0	1:3.04	110.5	150.5	1 9
June 30 to Aug. 12,	121.0	352.0	25.0	25.0	1:3.35	150.5	212.0	1 6
Aug. 13 to Sept. 16,	105.0	210.0	22.0	22.0	1:3.67	212.0	246.5	1 0

Total Amount of Feed Consumed from April 1 to Sept. 16.

406 lbs. Corn Meal, equal to dry matter,	357.4 lbs
1,211 qts. Skim-Milk, equal to dry matter,	274.7 "
55 lbs. Wheat Bran, equal to dry matter,	48.3 "
55 lbs. Gluten Meal, equal to dry matter,	50.3 "
Total amount of dry matter,	730.7 lbs.

Live weight of animal at beginning of experiment,	40.0 lbs.
Live weight at time of killing,	246.5 "
Live weight gained during experiment,	206.5 "
Dressed weight at time of killing,	210.0 "
Loss in weight by dressing,	36.5 lbs., or 14.8 per cent.
Dressed weight gained during experiment,	174.9 lbs.

Cost of Feed Consumed during Experiment.

406 lbs. of Corn Meal, at $24.00 per ton,	$4 87
303 gals. Skim-Milk, at 1.8 cents per gallon,	5 46
55 lbs. Wheat Bran, at $22.50 per ton,	0 62
55 lbs. Gluten Meal, at $22.50 per ton,	0 62
	$11 57

3.54 lbs. of dry matter fed yielded 1 lb. of live weight; and 4.18 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.6 cents.

[B.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at close of Period.	Gain in Weight per day during Period.
1885.								lb. oz.
April 1 to May 11,	73.5	257.0	–	–	1:3.29	59.5	109.3	1 3
May 12 to June 3,	57.5	184.0	–	–	1:3.39	109.3	133.3	1 1
June 4 to June 29,	65.0	208.0	13.0	13.0	1:3.27	133.3	188.5	2 2
June 30 to July 22,	69.0	184.0	17.0	17.0	1:3.39	188.5	223.0	1 8
July 23 to Sept. 16,	210.0	378.0	44.0	44.0	1:3.76	223.0	306.0	1 8

Total Amount of Feed Consumed from April 1 to Sept. 16.

475 lbs. Corn Meal, equal to dry matter,	418.2 lbs.
1,211 qts. Skim-Milk, equal to dry matter,	274.7 "
74 lbs. Wheat Bran, equal to dry matter,	65.1 "
74 lbs. Gluten Meal, equal to dry matter,	67.8 "
Total amount of dry matter,	825.8 lbs.

Live weight of animal at beginning of experiment,	59.5 lbs.
Live weight at time of killing,	306.0 "
Live weight gained during experiment,	246.5 "
Dressed weight at time of killing,	258.0 "
Loss in weight by dressing,	48 lbs., or 12.4 per cent.
Dressed weight gained during experiment,	205.9 lbs.

Cost of Feed Consumed during Experiment.

475 lbs. Corn Meal, at $24.00 per ton,	$5 70
303 gals. Skim-Milk, at 1.8 cents per gallon,	5 45
74 lbs. Wheat Bran at $22.50 per ton,	0 83
74 lbs. Gluten Meal, at $22.50 per ton,	0 83
	$12 81

3.35 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.01 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.2 cents.

Fourth Feeding Experiment (C, D).

Five animals served in the experiment; their live weights varied from 30 to 38 pounds when entering upon the trial; they were of a similar mixed breed as those selected for the third experiment. The daily diet of the entire lot consisted, from December 8 to February 15, of four quarts of skim-milk and eight ounces of corn meal, besides a mixture consisting of two weight parts of gluten meal and one weight part of wheat bran; the increase demand for feed was supplied by this mixture, which was moistened with water before being fed. The daily quantity needed per head amounted in the beginning of the trial to three ounces and rose towards the close of that period to 12 ounces. Subsequently — until the 11th of May — another mixture, consisting of equal weights of corn meal, gluten meal and wheat bran, was substituted in its place. After May 11 until the close of the experiment, May 31, a larger proportion of corn meal was fed. The daily diet consisted, during that period, of four quarts of skim-milk and a mixture of dry feed, consisting of seven parts of corn meal, one part of gluten meal and one part of wheat bran. On the 12th of May the daily diet consisted, on an average per head, of four quarts of skim-milk, twenty-eight ounces of corn meal, four ounces of gluten meal and four ounces of wheat bran. The consumption of the solid constituents of the daily fod-

der ration had reached, at the close of the experiment, in some instances, fifty-six ounces of corn meal, eight ounces of gluten meal and eight ounces of wheat bran. The daily quantity of milk fed remained the same during the entire experiment, — four quarts per head. Water was used to assist in moistening the dry portion of the feed.

A comparison of the subsequent statement of our results with those in the preceding experiment (III.) shows no marked differences; the results are, if anything, inferior, — considering the weight of the animals in both cases when killed. The cost of the feed consumed, per pound of dressed weight produced, varied from 6.1 to 6.6 cents; while from 3.77 to 4.08 pounds of dry matter contained in the feed consumed had yielded one pound of dressed pork.

The live weights gained during the experiment amounted to 128 and 111 pounds. The cost of feed consumed for the production of a given quantity of dressed pork *increases materially* with the *advancing growth* of the animal. For details concerning this important point see statement in our Third Annual Report. The financial success of feeding pigs for home market *depends*, in a *controlling degree*, on a *timely closing up of the operation*. To go beyond 160 — 175 pounds of live weight is only, in exceptional cases, a remunerative practice with our average market prices for dressed pork.

The beneficial effects of a more liberal supply of non-nitrogenous feed constituents, as starch and fats (in corn meal) during the last period of this feeding experiment, deserves particular attention.

[C.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at close of Period.	Gain in Weight per day during Period.
1885 and 1886.								lb. oz.
Dec. 8 to Jan. 25,	24.5	196.0	5.6	11.2	1:2.68	31.8	66.5	0 11
Jan. 26 to Feb. 15,	10.5	84.0	4.8	9.6	1:2.81	66.5	82.0	0 12
Feb. 16 to Mar. 23,	26.8	144.0	8.8	8.8	1:3.01	82.0	92.5	0 5
Mar. 24 to May 10,	28.6	232.0	5.6	5.6	1:2.66	92.5	119.0	0 9
May 11 to May 31,	55.4	84.0	8.2	8.2	1:4.33	119.0	142.8	1 2

Total Amount of Feed Consumed from Dec. 8 to May 31.

145.8 lbs. Corn Meal, equal to dry matter,	127.4 lbs.
740.0 qts. Skim-Milk, equal to dry matter,	167.8 "
33.0 lbs. Wheat Bran, equal to dry matter,	28.6 "
43.4 lbs. Gluten Meal, equal to dry matter,	40.5 "
Total amount of dry matter,	364.3 lbs.

Live weight of animal at beginning of experiment,	31.8 lbs.
Live weight at time of killing,	142.8 "
Live weight gained during experiment,	111.0 "
Dressed weight at time of killing,	115.0 "
Loss in weight by dressing,	27.8 lbs., or 19.3 per cent.
Dressed weight gained during experiment,	89.3 lbs.

Cost of Feed Consumed during Experiment.

145.8 lbs. Corn Meal, at $24.00 per ton,	$1 75
185.0 gals. Skim-Milk, at 1.8 cents per gallon,	3 30
33.1 lbs. Wheat Bran at $22.50 per ton,	0 37
43.4 lbs. Gluten Meal at $22.50 per ton,	0 49
	$5 91

3.28 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.08 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.6 cents.

[D.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at close of Period.	Gain in Weight per day during Period.
1885 and 1886.								lb. oz.
Dec. 8 to Jan. 25,	24.5	196.0	4.4	8.8	1:2.64	34.0	70.0	0 12
Jan. 26 to Feb. 15,	10.5	84.0	5.2	10.4	1:2.78	70.0	90.5	1 0
Feb. 16 to April 3,	38.7	188.0	15.2	15.2	1:3.06	90.5	118.0	0 9
April 4 to May 10,	25.8	188.0	7.3	7.3	1:2.86	118.0	137.5	0 8
May 11 to May 31,	60.0	81.0	8.4	8.4	1:4.48	137.5	162.0	1 2

Total Amount of Feed Consumed from Dec. 8 to May 31.

159.5 lbs. Corn Meal, equal to dry matter,	138.4 lbs.
737.0 qts. Skim-Milk, equal to dry matter,	167.2 "
40.5 lbs. Wheat Bran, equal to dry matter,	35.7 "
50.1 lbs. Gluten Meal, equal to dry matter,	46.0 "
Total amount of dry matter,	387.3 lbs.

Live weight of animal at beginning of experiment,	34.0 lbs.
Live weight at time of killing,	162.0 "
Live weight gained during experiment,	128.0 "
Dressed weight at time of killing,	130.0 "
Loss in weight by dressing,	32 lbs., or 19.7 per cent.
Dressed weight gained during experiment,	102.7 lbs.

Cost of Feed Consumed during Experiment.

159.5 lbs. Corn Meal, at $24.00 per ton,	$1 91
184.0 gals. Skim Milk, at 1.8 cents per gallon,	3 31
40.5 lbs. Wheat Bran, at $22.50 per ton,	0 46
50.1 lbs. Gluten Meal, at $22.50 per ton,	0 56
	$6 24

3.02 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.77 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.1 cents.

Fifth Feeding Experiment (E, F, G, H).

Six pigs of a mixed breed were secured for the observation; their live weights varied at the beginning of the experiment from 25 to 30 pounds. The course of feeding was similar to that adopted in the two previous experiments. Skim-milk and corn meal furnished, as in the previous trials, a liberal proportion of the daily diet; gluten meal and wheat bran were used in a somewhat different proportion than before as food ingredients to compound the desired temporary fodder ration. The feeding began with four quarts of skim-milk and eight ounces of corn meal; the increasing daily demand for feed was supplied by a mixture of equal weights of gluten meal and wheat bran until October 31, when a mixture of equal weights of gluten meal, corn meal and wheat bran took its place in providing the desired daily fodder ration, until the close of the experiment, January 15, 1887. At that time from forty-two to forty-eight ounces of this mixture were required per head.

The results of this experiment, judging from subsequent more detailed statements, are in some instances more favorable than those previously described; yet they fall behind those obtained in our earlier experiments (I. and II.). The cost of feed consumed per pound of dressed pork varied, in three cases, from 5.2 to 5.8 cents, and reached in one case 6.32 cents. The amount of dry matter in the food

consumed for the production of one pound of dressed pork varied, in three cases, from 3.56 to 3.99 pounds, and rose, in one case, to 4.31 pounds. The live weight gained during the entire experiment varied from 132 to 158 pounds. Two animals were sick for some weeks and appear not in the record below.

[E.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.)	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1886 and 1887.								lb. oz.
Sept. 15 to Oct. 4,	10.0	80.0	6.3	6.3	1:2.75	30.8	51.5	1 1
Oct. 5 to Oct. 31,	13.5	108.0	35.3	35.3	1:2.90	51.5	89.0	1 6
Nov. 1 to Dec. 10,	66.0	160.0	46.0	46.0	1:3.52	89.0	133.0	1 2
Dec. 11 to Jan. 15,	47.8	144.0	29.8	29.8	1:3.39	133.0	164.3	0 14

Total Amount of Feed Consumed from Sept. 15 to Jan. 15.

137.3 lbs. Corn Meal, equal to dry matter,	119.58 lbs.
492.0 qts. Skim-milk, equal to dry matter,	111.58 "
117.4 lbs. Wheat Bran, equal to dry matter,	102.99 "
117.4 lbs. Gluten Meal, equal to dry matter,	106.89 "
Total amount of dry matter,	441.04 lbs.

Live weight of animal at beginning of experiment,	30.8 lbs.
Live weight at the time of killing,	164.3 "
Live weight gained during experiment,	133.5 "
Dressed weight at time of killing,	136.0 "
Loss in weight by dressing,	28.5 lbs., or 17.3 per cent.
Dressed weight gained during experiment,	110.5 lbs.

Cost of Feed Consumed during Experiment.

137.3 lbs. Corn Meal, at $24.00 per ton,	$1 64
123.0 gals. of Skim-milk, at 1.8 cents per gallon,	2 21
117.4 lbs. Wheat Bran, at $22.50 per ton,	1 32
117.4 lbs. Gluten Meal, at $22.50 per ton,	1 32
	$6.49

3.30 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.99 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.8 cents.

[F.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.)	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1886 and **1887.**								lb. oz.
Sept. 15 to Oct. 4,	10.0	80.0	6.3	6.3	1:2.75	34.5	56.3	1 1
Oct. 5 to Oct. 31,	13.5	108.0	35.0	35.0	1:2.90	56.3	99.5	1 10
Nov. 1 to Dec. 10,	69.3	160.0	49.3	49.3	1:3.57	99.5	156.3	1 7
Dec. 11 to Jan. 19,	58.0	160.0	38.0	38.0	1:3.45	156.3	193.3	0 15

Total Amount of Feed Consumed from Sept. 15 to Jan. 19.

150.8 lbs. Corn Meal, equal to dry matter,	131.77 lbs.
508.0 qts. Skim-milk, equal to dry matter,	115.21 "
128.6 lbs. Wheat Bran, equal to dry matter,	113.10 "
128.6 lbs. Gluten Meal, equal to dry matter,	117.10 "
Total amount of dry matter,	477.18 lbs.

Live weight of animal at beginning of experiment,	34.5 lbs.
Live weight at time of killing,	193.3 "
Live weight gained during experiment,	158.8 "
Dressed weight at time of killing,	163.0 "
Loss in weight by dressing,	30.3 lbs., or 15.7 per cent.
Dressed weight gained during experiment,	133.9 lbs.

Cost of Feed Consumed during Experiment.

150.8 lbs. Corn Meal, at $24.00 per ton,	$1 81
127.0 gals. Skim-milk at 1.8 cents per gallon,	2 29
128.6 lbs. Wheat Bran, at $22.50 per ton,	1 45
128.6 lbs. Gluten Meal, at $22.50 per ton,	1 45
	$7 00

3.04 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.56 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.2 cents.

[G.]

Total Amount of Feed Consumed from Sept. 15 to Jan. 19.

150.0 lbs. Corn Meal, equal to dry matter,	131.07 lbs.
508.0 qts. Skim-milk, equal to dry matter,	115.21 "
128.0 lbs. Wheat Bran, equal to dry matter,	112.58 "
128.0 lbs. Gluten Meal, equal to dry matter,	116.54 "
Total amount of dry matter,	475.40 lbs.

Live weight of animal at beginning of experiment,	32.0 lbs.
Live weight at time of killing,	164.0 "
Live weight gained during experiment,	132.0 "
Dressed weight at time of killing,	137.0 "
Loss in weight by dressing,	27.0 lbs., or 16.4 per cent.
Dressed weight gained during experiment,	110.2 lbs.

Cost of Feed Consumed during Experiment.

150.0 lbs. Corn Meal, at $24.00 per ton,	$1 80
127.0 gals. Skim-milk, at 1.8 cents per gallon,	2 29
128.0 lbs. Wheat Bran, at $22.50 per ton	1 44
128.0 lbs. Gluten Meal, at $22.50 per ton,	1 44
	$6 97

3.60 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.31 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.3 cents.

[H.]

Total Amount of Feed Consumed, from Sept. 15 to Jan. 19.

149.5 lbs. Corn Meal, equal to dry matter,	130.63 lbs.
508.0 qts. Skim-milk, equal to dry matter,	115.21 "
127.4 lbs. Wheat Bran, equal to dry matter,	112.05 "
127.4 lbs. Gluten Meal, equal to dry matter,	116.00 "
Total amount of dry matter,	473.89 lbs.

Live weight of animal at beginning of experiment,	33.0 lbs.
Live weight at time of killing,	178.3 "
Live weight gained during experiment,	145.3 "
Dressed weight at time of killing,	153.0 "
Loss in weight by dressing,	25.3 lbs., or 14.2 per cent.
Dressed weight gained during experiment,	124.7 lbs.

Cost of Feed Consumed during Experiment.

149.5 lbs. Corn meal, at $24.00 per ton,	$1 79
127.0 gals. Skim-milk, at 1.8 cents per gallon,	2 29
127.4 lbs. Wheat Bran, at $22.50 per ton,	1 43
127.4 lbs. Gluten Meal, at $22.50 per ton,	1 43
	$6 94

3.26 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.80 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.6 cents.

SUMMARY OF EXPERIMENTS III., IV., V.

		Corn Meal (in lbs.).	Skim-milk (in gals.).	Wheat Bran (in lbs.).	Gluten Meal (in lbs.).	Live Weight gained during Experiment.	Dressed Weight gained during Experiment.	Cost per Pound of Dressed Pork (cents).
III.	A,	406.0	303.0	55.0	55.0	206.5	174.9	6.6
	B,	475.0	303.0	74.0	74.0	243.5	205.9	6.2
IV.	C,	145.8	185.0	33.0	43.4	111.0	89.3	6.6
	D,	159.5	184.0	40.5	50.1	128.0	102.7	6.1
V.	E,	137.3	123.0	117.4	117.4	133.5	110.5	5.8
	F,	150.8	127.0	128.6	128.6	158.8	133.9	5.2
	G,	150.0	127.0	128.0	128.0	132.0	110.2	6.3
	H,	149.5	127.0	127.4	127.4	145.3	153.0	5.6
		1,773.9	1,479.0	703.9	703.9	1,261.6	1,080.4	–

Total Cost of Feed Consumed during the above-stated Experiments.

1,773.9 lbs. Corn Meal,	$21 28
1,479.0 gals. Skim-milk,	26 62
703.9 lbs. Wheat Bran,	7 92
723.9 lbs. Gluten Meal,	8 14
	$63 96

Average cost of feed for production of 1 lb. of dressed pork, 5.92 cents.

Manurial Value of the Feed Consumed during the above Experiments.

Corn Meal.	Skim Milk.	Wheat Bran.	Gluten Meal.	Total.
$7 07	$13 31	$4 75	$6 33	$31 46

Total manurial value of feed for production of 1 lb. of dressed pork 2.91 cents.

SIXTH FEEDING EXPERIMENT (I, J, K, L, M).

Seven animals of a mixed breed were selected for the trial; their live weight varied from 40 to 60 pounds; five of them remained well; two became sick and dropped out of the experiment.

The feeding began Feb. 17th, with a daily ration of seven quarts of milk, twenty-one ounces of corn meal and seven ounces each of wheat bran and gluten meal. The amount of skim-milk and corn meal remained the same during the entire trial, and a mixture of equal weight parts of gluten meal and wheat bran supplied subsequently the increasing demand for feed. Seven quarts of skim-milk, twenty-one ounces of corn meal and twenty-one ounces of

the stated mixture were fed daily to each animal, at the close of the trial, May 2, 1887. The cost of feed consumed, per pound of dressed pork produced, varied from 6.72 to 4.32 cents. Taking the entire amount of dressed pork produced, during the experiment, into consideration, the cost of feed per pound of dressed pork amounts to 5.69 cents. The amount of dry matter contained in the feed required to produce one pound of dressed pork varied from 2.70 to 4.15 pounds.

[I.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
Feb. 17 to Mar. 3,	19.7	105.0	6.6	6.6	1:2.99	42.0	62.5	1 6
Mar. 4 to Mar. 23,	32.8	175.0	16.4	16.4	1:3.13	62.5	98.5	1 7
Mar. 29 to May 2,	61.3	245.0	16.6	16.6	1:3.23	98.5	126.5	0 13

Total Amount of Feed Consumed from Feb. 17 to May 2.

113.8 lbs. Corn Meal, equal to dry matter,	99.43 lbs.
525.0 qts. Skim-milk, equal to dry matter,	119.07 "
39.6 lbs. Wheat Bran, equal to dry matter,	34.83 "
39.6 lbs. Gluten Meal, equal to dry matter,	36.05 "
Total amount of dry matter,	289.38 lbs.
Live weight of animal at beginning of experiment,	42.0 lbs.
Live weight of animal at time of killing,	126.5 "
Live weight gained during experiment,	84.5 "
Dressed weight at time of killing,	104.4 "
Loss in weight by dressing,	22.1 lbs. or 17.5 per cent.
Dressed weight gained during experiment,	69.7 lbs.

Cost of Feed Consumed during Experiment.

113.8 lbs. Corn Meal, at $24.00 per ton,	$1 37
131.0 gals. Skim-milk, at 1.8 cents per gallon,	2 36
39.6 lbs. Wheat Bran, at $22.50 per ton,	45
39.6 lbs. Gluten Meal, at $22.50 per ton,	45
	$4 63

3.42 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.15 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.6 cents.

[J.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
Feb. 17 to Mar. 3,	19.7	105.0	6.6	6 6	1:2.99	63.5	87.0	1 9
Mar. 4 to Mar. 28,	32.8	175.0	16.4	16.4	1:3.13	87.0	123.0	1 7
Mar. 29 to May 2,	61.3	245.0	16.6	16.6	1:3.23	123.0	173.0	1 7

Total Amount of Feed Consumed from Feb. 17 to May 2.

113.8 lbs. Corn Meal, equal to dry matter,	99.43 lbs.
525.0 qts. Skim-milk, equal to dry matter,	119.07 "
39.6 lbs. Wheat Bran, equal to dry matter,	34.83 "
39.6 lbs. Gluten Meal, equal to dry matter,	36.05 "
Total amount of dry matter,	289.38 lbs.

Live weight of animal at beginning of experiment,	63.5 lbs.
Live weight of animal at time of killing,	173.0 "
Live weight gained during experiment,	109.5 "
Dressed weight at time of killing,	142.7 "
Loss in weight by dressing,	30.3 lbs., or 17.5 per cent.
Dressed weight gained during experiment,	90.3 lbs.

Cost of Feed Consumed during Experiment.

113.8 lbs. Corn Meal, at $24.00 per ton,	$1 37
131.0 gals. Skim-milk, at 1.8 cents per gallon,	2 36
39.6 lbs. Wheat Bran at $22.50 per ton,	45
39.6 lbs. Gluten Meal at $22.50 per ton,	45
	$4 63

2.64 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.20 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.1 cents.

[K.]

Total Amount of Feed Consumed from Feb. 17 to May 2.

113.8 lbs. Corn Meal, equal to dry matter,	99.43 lbs.
525.0 qts. Skim-milk, equal to dry matter,	119.07 "
39.6 lbs. Wheat Bran, equal to dry matter,	34.83 "
39.6 lbs. Gluten Meal, equal to dry matter,	36.05 "
Total amount of dry matter,	289.38 lbs.

Live weight of animal at beginning of experiment,	61.5 lbs.
Live weight of animal at time of killing,	145.0 "
Live weight gained during experiment,	83.5 "
Dressed weight at time of killing,	119.6 "
Loss in weight by dressing	2.54 lbs., or 17.5 per cent.
Dressed weight gained during experiment,	68.9 lbs.

Cost of Feed Consumed during Experiment.

113.8 lbs. Corn Meal, at $24.00 per ton,	$1 37
131.0 gals. Skim-milk, at 1.8 cents per gallon,	2 36
39.6 lbs. Wheat Bran, at $22.50 per ton,	45
39.6 lbs. Gluten Meal, at $22.50 per ton,	45
	$4 63

3.47 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.20 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.72 cents.

[L.]

Total Amount of Feed Consumed from Feb. 17 to May 2.

113.8 lbs. Corn Meal, equal to dry matter,	99.43 lbs.
525.0 qts. Skim-milk, equal to dry matter,	119.07 "
39.6 lbs. Wheat Bran, equal to dry matter,	34.83 "
39.6 lbs. Gluten Meal, equal to dry matter,	36.05 "
Total amount of dry matter,	289.36 lbs.

Live weight of animal at beginning of experiment,	59.0 lbs.
Live weight of animal at time of killing,	143.5 "
Live weight gained during experiment,	84.5 "
Dressed weight at time of killing,	118.4 "
Loss in weight by dressing,	25.1, or 17.5 per cent.
Dressed weight gained during experiment,	69.7 lbs.

Cost of Feed Consumed during Experiment.

113.8 lbs. Corn Meal, at $24.00 per ton,	$1 37
131.0 gals. of Skim-milk, at 1.8 cents per gallon,	2 36
39.6 lbs. Wheat Bran, at $22.50 per ton,	45
39.6 lbs. Gluten Meal, at $22.50 per ton,	45
	$4 63

3.42 lbs. of dry matter fed yielded 1 lb. of live weight, and 4.15 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 6.64 cents.

[M.]

Total Amount of Feed Consumed from Feb. 17 to May 2.

113.8 lbs. Corn Meal, equal to dry matter,	99.43 lbs.
525.0 qts. Skim-milk, equal to dry matter,	119.07 "
39.6 lbs. Wheat Bran, equal to dry matter,	34.83 "
39.6 lbs. Gluten Meal, equal to dry matter,	36.05 "
Total amount of dry matter,	289.38 lbs.

Live weight of animal at beginning of experiment, . . 46.0 lbs.
Live weight of animal at time of killing, ... 176.0 "
Live weight gained during experiment, ... 130.0 "
Dressed weight at time of killing, ... 145.2 "
Loss in weight by dressing, . . . 30.8 lbs., or 17.5 per cent.
Dressed weight gained during experiment, . . . 107.2 lbs.

Cost of Feed Consumed during Experiment.

113.8 lbs. Corn Meal, at $24.00 per ton, ...	$1 37
131.0 gals. Skim-milk, 1.8 cents per gallon, ...	2 36
39.6 lbs. Wheat Bran, at $22.50 per ton, ...	45
39.6 lbs. Gluten Meal, at $22.50 per ton, ...	45
	$4 63

2.23 lbs. of dry matter fed yielded 1 lb. of live weight, and 2.70 lbs. of dry matter yielded 1 lb. of dressed weight.
Cost of feed for production of 1 lb. of dressed pork, 4.32 cents.

SUMMARY OF EXPERIMENT VI.

	Corn Meal (in lbs.).	Skim-milk (in gallons).	Wheat Bran (in lbs.).	Gluten Meal (in lbs.).	Live Weight gained during Experiment.	Dressed Weight gained during Experiment.	Cost per Pound of Dressed Pork (cents).
I, ...	113.8	131.0	39.6	39.6	84.5	69.7	6.6
J, ...	113.8	131.0	39.6	39.6	109.5	90.3	5.1
K, ...	113.8	131.0	39.6	39.6	83.5	68.9	6.72
L, ...	113.8	131.0	39.6	39.6	84.5	69.7	6.64
M, ...	113.8	131.0	39.6	39.6	130.0	107.2	4.32
	569.0	655.0	198.0	198.0	492.0	405.8	–

Total Cost of Feed Consumed during the above-stated Experiment.

569.0 lbs. Corn Meal, ...	$6 83
655.0 gals. Skim-milk, ...	11 79
198.0 lbs. Wheat Bran, ...	2 23
198.0 lbs. Gluten Meal, ...	2 23
	$23.08

Average cost of feed for production of 1 lb. of dressed pork, 5.69 cents.

Manurial Value of the Feed Consumed during the above Experiment.

Corn Meal.	Skim-milk.	Wheat Bran.	Gluten Meal.	Total.
$2 27	$5 94	$1 33	$1 73	$11 27

Manurial value of feed for production of 1 lb. of dressed pork, 2.78 cents.

Seventh Feeding Experiment.

Seven animals, crosses between White Chester and Black Berkshire, served in this experiment. Their live weights were from twenty-two to twenty-six pounds in case of different animals. The same fodder articles were used as in the third, fourth, fifth and sixth experiments; they were, however, fed in different proportions. The daily ration of corn meal was gradually increased during the progress of the experiment, for the purpose of altering the relative proportion between the nitrogenous and non-nitrogenous matter in the feed. The relative proportion of one part of digestible nitrogenous matter to two and nine-tenth parts of non-nitrogenous matter was changed at stated periods until it reached 1 : 4.28.

Average of Daily Rations.

	Corn Meal (ounces).	Skim-milk (quarts).	Wheat Bran (ounces).	Gluten Meal (ounces).
June 28 to July 11,	8.00	4	–	–
July 12 to July 25,	12.00	6	–	–
July 26 to July 28,	12.00	6	1.34	2.66
July 29 to Aug. 8,	12.00	6	2.00	4.00
Aug. 9 to Aug. 15,	14.67	6	2.66	2.66
Aug. 16 to Aug. 23,	17.34	6	5.33	5.33
Aug. 24 to Aug. 29,	20.00	6	8.00	8.00
Aug. 30 to Sept. 12,	23.34	6	11.35	11.35
Sept. 13 to Sept. 26,	29.00	6	17.00	17.00
Sept. 27 to Oct. 11,	47.00	6	12.00	12.00
Oct. 12 to Oct. 27,	62.66	6	15.66	15.66

The cost of feed consumed varied, in case of different animals, from 4.80 to 5.49 cents per pound of dressed pork produced.

Taking the entire lot of animals into consideration it amounts to 5.15 cents per pound of dressed pork obtained. The amount of dry matter contained in the feed required for the production of one pound of dressed pork varied from 2.83 to 3.24 lbs.

[N.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	25.75	47.00	0 12
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	47.00	63.50	1 1
Aug. 9 to Sept. 26,	68.59	294.0	31.83	31.83	1:3.39	63.50	130.50	1 6
Sept. 27 to Oct. 27,	106.34	186.0	26.58	26.58	1:4.30	130.50	189.50	1 14

Total Amount of Feed Consumed from June 28 to Oct. 27.

202.93 lbs. Corn Meal, equal to dry matter, . . .	176.39 lbs.
704 qts. Skim-milk, equal to dry matter, ...	126.72 "
60.04 lbs. Wheat Bran, equal to dry matter, . . .	53.35 "
61.66 lbs. Gluten Meal, equal to dry matter, . . .	55.46 "
Total amount of dry matter, ...	441.92 lbs.

Live weight of animal at beginning of experiment, . .	25.75 lbs.
Live weight at time of killing, ...	189.50 "
Live weight gained during experiment, ...	163.75 "
Dressed weight at time of killing, ...	148.00 "
Loss in weight by dressing, ...	41 lbs., or 21 per cent.
Dressed weight gained during experiment, ...	129.36 lbs.

Cost of Feed Consumed during Experiment.

202.93 lbs. Corn Meal, at $24.00 per ton, ...	$2 44
176 gals. Skim-milk, at 1.8 cents per gallon, ...	3 17
60.04 lbs. Wheat Bran, at $22.50 per ton, ...	68
61.66 lbs. Gluten Meal, at $22.50 per ton, ...	69
	$6 98

2.51 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.18 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.39 cents.

[O.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	23.50	44.00	0 11
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	44.00	61.00	1 3
Aug. 9 to Sept. 26,	68.75	294.0	32.00	32.00	1:3.34	61.00	125.00	1 5
Sept. 27 to Oct. 27,	106.34	186.0	26.58	26.58	1:4.30	125.00	184.50	1 14

Total Amount of Feed Consumed from June 28 to Oct. 27.

203.09 lbs. Corn Meal, equal to dry matter,	176.53 lbs.
704 qts. Skim-milk, equal to dry matter,	126.72 "
60.21 lbs. Wheat Bran, equal to dry matter,	53.51 "
61.83 lbs. Gluten Meal, equal to dry matter,	55.62 "
Total amount of dry matter,	412.38 lbs.

Live weight of animal at beginning of experiment,	23.50 lbs.
Live weight at time of killing,	184.50 "
Live weight gained during experiment,	161.00 "
Dressed weight at time of killing,	144.00 "
Loss in weight by dressing,	40.5 lbs., or 21 per cent.
Dressed weight gained during experiment,	127.19 lbs.

Cost of Feed Consumed during Experiment.

203.09 lbs. Corn Meal, at $24.00 per ton,	$2 44
176 gals. Skim-milk, at 1.8 cents per gallon,	3 17
60.21 lbs. Wheat Bran, at $22.50 per ton,	68
61.83 lbs. Gluten Meal, at $22.50 per ton,	70
	$6 99

2.56 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.24 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.49 cents.

[P.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	23.00	45.00	0 12
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	45.00	61.50	1 2
Aug. 9 to Sept. 26,	68.75	294.0	32.00	32.00	1:3.34	61.50	138.50	1 9
Sept. 27 to Oct. 27,	106.34	186.0	26.58	26.58	1:4.30	138.50	197.00	1 14

Total Amount of Feed Consumed from June 28 to Oct. 27.

203.09 lbs. Corn Meal, equal to dry matter,	176.53 lbs.
704 qts. Skim-milk, equal to dry matter,	126.72 "
60.21 lbs. Wheat Bran, equal to dry matter,	53.51 "
61.83 lbs. Gluten Meal, equal to dry matter,	55.62 "
Total amount of dry matter,	412.38 lbs.

Live weight of animal at beginning of experiment,	23.00 lbs.
Live weight at time of killing,	197.00 "
Live weight gained during experiment,	174.00 "
Dressed weight at time of killing,	156.00 "
Loss in weight by dressing,	41 lbs., or 20 per cent.
Dressed weight gained during experiment,	139.20 lbs.

Cost of Feed Consumed during Experiment.

203.9 lbs. Corn Meal, at $24.00 per ton,	$2 44
176 gals. Skim-milk, at 1.8 cents per gallon,	3 17
60.21 lbs. Wheat Bran, at $22.50 per ton,	68
61.83 lbs. Gluten Meal, at $22.50 per ton,	70
	$6 99

2.37 lbs. of dry matter fed yielded 1 lb. of live weight, and 2.96 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.02 cents.

[Q.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in weight per day during period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	28.50	54.75	0 15
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	54.75	70.75	1 2
Aug. 9 to Sept. 26,	68.41	294.0	31.67	31.67	1:3.34	70.75	143.00	1 8
Sept. 27 to Oct. 25,	97.68	174.00	24.41	24.41	1:4.28	143.00	193.00	1 9

Total Amount of Feed Consumed from June 28 to Oct. 25.

194.09 lbs. Corn Meal, equal to dry matter,	168.70 lbs.
692 qts. Skim-milk, equal to dry matter,	124.56 "
57.71 lbs. Wheat Bran, equal to dry matter,	51.28 "
59.33 lbs. Gluten Meal, equal to dry matter,	53.37 "
Total amount of dry matter,	397.91 lbs.

Live weight of animal at beginning of experiment,	28.50 lbs.
Live weight at time of killing,	193.00 "
Live weight gained during experiment,	164.50 "
Dressed weight at time of killing,	158.00 "
Loss in weight by dressing,	35 lbs., or 22 per cent.
Dressed weight gained during experiment,	128.31 lbs.

Cost of Feed Consumed during Experiment.

194.09 lbs. Corn Meal, at $24.00 per ton,	$2 32
173 gals. Skim-milk, at 1.8 cents per gallon,	3 11
57.71 lbs. Wheat Bran, at $22.50 per ton,	65
59.93 lbs. Gluten Meal at $22.50 per ton,	68
	$6 76

2.41 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.10 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.27 cents.

[R.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	23.50	50.00	0 15
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2 85	50.00	65.25	1 1
Aug. 9 to Sept. 26,	68.75	294.0	32.00	32.00	1:3.34	65.25	144.25	1 9
Sept. 27 to Oct. 25,	97.68	174.0	24.41	24.41	1:4.23	144.25	201.00	1 13

Total Amount of Feed Consumed from June 28 to Oct. 25.

194.43 lbs. Corn Meal, equal to dry matter,	169.00 lbs.
692 qts. Skim-milk, equal to dry matter,	124.56 "
58.04 lbs. Wheat Bran, equal to dry matter,	51.58 "
59.66 lbs. Gluten Meal, equal to dry matter,	53.67 "
Total amount of dry matter,	398.81 lbs.

Live weight of animal at beginning of experiment,	23.50 lbs.
Live weight at time of killing,	201.00 "
Live weight gained during experiment,	177.50 "
Dressed weight at time of killing,	156.00 "
Loss in weight by dressing,	45 lbs., or 22 per cent.
Dressed weight gained during experiment,	138.45 lbs.

Cost of Feed Consumed during Experiment.

194.43 lbs. Corn Meal, at $24.00 per ton,	$2 33
173 gals. Skim-milk, at 1.8 cents per gallon,	3 11
58.04 lbs. Wheat Bran, at $22.50 per ton,	65
59.66 lbs. Gluten Meal, at $22.50 per ton,	67
	$6 76

2.24 lbs. of dry matter fed yielded 1 lb. of live weight, and 2.88 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 4.89 cents.

[S.]

PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	21.50	48.00	0 15
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	48.00	63.00	1 1
Aug. 9 to Sept. 26,	68.75	294.0	32.00	32.00	1:3.34	63.00	135.00	1 7
Sept. 27 to Oct. 25,	97.68	174.0	24.41	24.41	1:4.28	135.00	184.00	1 9

Total Amount of Feed Consumed from June 28 to Oct. 25.

194.43 lbs. Corn Meal, equal to dry matter,	169.00 lbs.
692 qts. Skim-milk equal to dry matter,	124.56 "
58.04 lbs. Wheat Bran, equal to dry matter,	51.58 "
59.66 lbs. Gluten Meal, equal to dry matter,	53.67 "
Total amount of dry matter,	398.81 lbs.

Live weight of animal at beginning of experiment,	21.50 lbs.
Live weight at time of killing,	184.00 "
Live weight gained during experiment,	162.50 "
Dressed weight at time of killing,	145.00 "
Loss in weight by dressing,	39 lbs. or 21 per cent.
Dressed weight gained during experiment,	128.38 lbs.

Cost of Feed Consumed during Experiment.

194.43 lbs. Corn Meal, at $24.00 per ton,	$2 33
173 gals. Skim-milk, at 1.8 cents per gallon,	3 11
58.04 lbs. Wheat Bran, at $22.50 per ton,	65
59.66 lbs. Gluten Meal, at $22.50 per ton,	67
	$6 76

2.45 lbs. of dry matter fed yielded 1 lb. of live weight, and 3.10 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 5.26 cents.

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PERIODS.	Total amount of Corn Meal Consumed during Period (in lbs.).	Total amount of Skim-milk Consumed during Period (in qts.).	Total amount of Wheat Bran Consumed during Period (in lbs.).	Total amount of Gluten Meal Consumed during Period (in lbs.).	Nutritive Ratio of Food.	Weight of Animal at beginning of Period.	Weight of Animal at end of Period.	Gain in Weight per day during Period.
1887.								lb. oz.
June 28 to July 25,	17.50	140.0	–	–	1:2.91	25.75	53.50	0 15
July 26 to Aug. 8,	10.50	84.0	1.63	3.25	1:2.85	53.50	70.00	1 2
Aug. 9 to Sept. 26,	68.75	294.0	32.00	32.00	1:3.34	70.00	147.00	1 9
Sept. 27 to Oct. 25,	97.68	174.0	24.41	24.41	1:4.28	147.00	204.00	1 13

Total Amount of Feed Consumed from June 28 to Oct. 25.

194.43 lbs. Corn Meal, equal to dry matter,	169.00 lbs.
692 qts. Skim-milk, equal to dry matter,	124.56 "
58 04 lbs. Wheat Bran, equal to dry matter,	51.58 "
59.66 lbs. Gluten Meal, equal to dry matter,	53.67 "
Total amount of dry matter,	398.81 lbs.

Live weight of animal at beginning of experiment,	25.75 lbs.
Live weight at time of killing,	204.00 "
Live weight gained during experiment,	178.25 "
Dressed weight at time of killing,	162.00 "
Loss in weight by dressing,	42 lbs., or 21 per cent.
Dressed weight gained during experiment,	140.85 lbs.

Cost of Feed Consumed during Experiment.

194.43 lbs. Corn Meal, at $24.00 per ton,	$2 33
173 gals. Skim-milk, at 1.8 cents per gallon,	3 11
58.04 lbs. Wheat Bran, at $22.50 per ton,	65
59.66 lbs. Gluten Meal, at $22.50 per ton,	67
	$6 76

2.23 lbs. of dry matter fed yielded 1 lb. of live weight; and 2.83 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of dressed pork, 4.80 cents.

SUMMARY OF EXPERIMENT VII.

	Corn Meal (in lbs.).	Skim-milk (in gals.).	Wheat Bran (in lbs.).	Gluten Meal (in lbs.).	Live Weight gained during Experiment.	Dressed Weight gained during Experiment.	Cost per pound of Dressed Pork (cents).
N,	202.93	176.0	60.04	61.66	163.75	129.36	5.39
O,	203.09	176.0	60.21	61.83	161.00	127.19	5.49
P,	203.00	176.0	60.21	61.83	174.00	139.20	5.02
Q,	194.09	173.0	57.71	59.93	164.50	128.31	5.27
R,	194.43	173.0	58.04	59.66	177.50	138.45	4.89
S,	194.43	173.0	58.04	59.66	162.50	128.38	5.26
T,	194.43	173.0	58.04	59.66	178.25	140.85	4.80
	1,386.40	1,220.0	412.29	424.23	1,181.50	931.74	-

Total Cost of Feed consumed during the above-stated Experiment.

1,386.40 lbs. Corn Meal,	$16 64
1,220.0 gals. Skim-milk,	21 96
412.29 lbs. Wheat Bran,	4 64
424.23 lbs. Gluten Meal,	4 77
	$48 01

Average cost of feed for production of 1 lb. of dressed pork, 5.15 cents.

Manurial Value of the Feed consumed during the above Experiment.

Corn Meal.	Skim-milk.	Wheat Bran.	Gluten Meal.	Total.
$5 52	$11 32	$2 97	$3 71	$23 52

Manurial value of feed for production of 1 lb. of dressed pork, 2.52 cents.

Taking for granted that in raising one and the same kind of animals to corresponding weights, practically the same amount of nitrogen, phosphoric acid, potassa, etc., will be retained in the animal system, it follows that the excess of any one of these constituents of one diet as compared with another one must count in favor of the higher commercial value of the manurial residue of that particular diet.

Accepting this view regarding the final determination of net cost of feed as correct, it will be noticed, in the subse-

quent summary of our previously described six feeding experiments, that an addition of gluten meal and wheat bran to a diet consisting of skim-milk and corn meal, reduces the cost of dressed pork, in consequence of the higher value of the manurial refuse obtained. As we sold our dressed pork for from $5\frac{1}{2}$ to $7\frac{1}{2}$ cents per pound, we received from 1.5 to 3.5 cents for labor, housing, etc.

Our seventh feeding experiment has given us the most satisfactory pecuniary results; for the net cost of feed consumed amounted to 3.39 cents per pound of dressed pork produced, after allowing a loss of thirty per cent. of the manurial value of the feed, in consequence of the growth of the animal.

SUMMARY OF EXPERIMENTS II., III., IV., V., VI., VII.

EXPERIMENTS.	Average amount of Dry Matter for production of one pound of Dressed Pork (lbs.).	Cost of Feed per pound of Dressed Pork (cents).	Manurial Value of Feed per pound of Dressed Pork (cents).	Net Cost of Feed per pound of Dressed Pork, after deducting 30 per cent. from Manurial Value (cents).
II.,	3.31	5.51	2.30	3.90
III., IV., V.,	3.86	5.92	2.91	3.88
VI.,	3.56	5.69	2.73	3.74
VII.,	3.07	5.15	2.52	3.39

Valuation of Essential Fertilizing Constituents contained in the Various Articles of Fodder used.

	PER CENT.			
	Corn Meal.	Skim-milk.	Wheat Bran.	Gluten Meal.
Moisture,	10.00	90.00	10.80	8.80
Nitrogen (17 cents per pound),	1.96	0.55	2.80	5.03
Phosphoric acid (6 cents per pound),	0.77	0.17	2.36	0.30
Potassium oxide ($4\frac{1}{4}$ cents per pound),	0.45	0.20	1.36	0.03
Valuation per 2,000 pounds,	$7 97	$2 25	$13 51	$17 49

Average Analysis of Skim-milk.

	Per cent.
Moisture at 100° C.,	89.78
Dry Matter,	10.22
	100.00

Analysis of Dry Matter.

Ash (Mineral Matter),	7.82
Fat,	3.23
Protein (Nitrogenous Matter),	34.54
Non-nitrogenous Extract Matter,	54.40
	100.00

Nutritive Ratio, 1 : 1.8.

The skim-milk contained 10.22 per cent. of solids; one quart of it weighed 35.5 ounces, and contained 3.63 ounces of solids; one gallon contained 14.52 ounces of dry organic matter.

Used in the second, third, fourth, fifth and sixth experiments.

SKIM-MILK.

[Average of two Analyses.]

	Per cent.
Moisture at 100° C.,	91.00
Dry Matter,	9.00
	100.00

Analysis of Dry Matter.

Ash (Mineral Matter),	6.67
Fat,	2.78
Protein (Nitrogenous Matter),	34.00
Non-nitrogenous Extract Matter,	56.55
	100.00

Nutritive Ratio, 1 : 1.86.

Used in the seventh feeding experiment.

GLUTEN MEAL.

99.82 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.45	169.00	–	–	
Dry Matter,	91.55	1,831.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	0.76	15.20	–	–	
" Cellulose,	1.73	34.60	11.76	34	1 : 2.27
" Fat,	9.34	186.80	141.97	76	
" Protein (Nitrogenous Matter),	35.31	706.20	600.27	85	
Non-nitrogenous Extract Matter,	52.86	1,057.20	993.76	94	
	100.00	2,000.00	1,747.76	–	

Used in the third experiment.

GLUTEN MEAL.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.95	179.00	–	–	
Dry Matter,	91.05	1,821.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	0.76	15.20	–	–	
" Cellulose,	1.58	31.60	10.74	34	1 : 3.00
" Fat,	7.51	150.20	114.15	76	
" Protein (Nitrogenous Matter),	30.81	616.20	523.77	85	
Non-nitrogenous Extract Matter,	59.34	1,186.80	1,115.59	94	
	100.00	2,000.00	1,764.25	–	

Used in the fourth, fifth and sixth experiments.

GLUTEN MEAL.

91.44 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.04	200.80	–	–	
Dry Matter,	89.96	1,799.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	0.78	15.60	–	–	
" Cellulose,	4.45	89.00	30.26	34	
" Fat,	9.34	186.80	141.96	76	1 : 2.27
" Protein (Nitrogenous Matter),	34.67	693.40	589.59	85	
Non-nitrogenous Extract Matter,	50.76	1,015.20	954.29	94	
	100.00	2,000.00	1,716.10	–	

Used in the seventh feeding experiment.

CORN MEAL.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.62	252.40	–	–	
Dry Matter,	87.38	1,747.60	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.56	31.20	–	–	
" Cellulose,	2.66	53.20	18.09	34	
" Fat,	4.27	85.40	64.90	76	1 : 8.76
" Protein (Nitrogenous Matter),	11.43	228.60	194.31	85	
Non-nitrogenous Extract Matter,	80.08	1,601.60	1,505.50	94	
	100.00	2,000.00	1,782.80	–	

Used in the second, fourth, fifth and sixth experiments.

CORN MEAL.

93.28 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	11.95	239.00	–	–	
Dry Matter,	88.05	1,761.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.59	31.80	–	–	
" Cellulose,	2.59	51.80	17.61	34	1 : 7.42
" Fat,	4.43	88.60	67.34	76	
" Protein (Nitrogenous Matter),	13.13	262.60	223.21	85	
Non-nitrogenous Extract Matter,	78.26	1,565.20	1,471.29	–	
	100.00	2,000.00	1,779.45	–	

Used in the third feeding experiment.

CORN MEAL.

[Average of two Analyses.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	13.08	261.60	–	–	
Dry Matter,	86.92	1,738.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.66	33.20	–	–	
" Cellulose,	3.49	69.80	23.73	34	1 : 9.66
" Fat,	4.97	99.40	75.54	76	
" Protein (Nitrogenous Matter),	10.39	207.80	176.63	85	
Non-nitrogenous Extract Matter,	79.49	1,589.80	1,494.41	94	
	100.00	2,000.00	1,770.41	–	

Used in the seventh feeding experiment.

WHEAT BRAN.

81.93 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.05	241.00	–	–	
Dry Matter,	87.95	1,729.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.64	132.80	–	–	
" Cellulose,	11.49	229.80	45.96	20	1 : 3.77
" Fat,	4.75	95.00	76.00	80	
" Protein (Nitrogenous Matter),	17.86	357.20	314.34	88	
Non-nitrogenous Extract Matter,	59.26	1,185.20	948.16	80	
	100.00	2,000.00	1,384.46	–	

Used in the third, fourth, fifth and sixth experiments.

WHEAT BRAN.

73.36 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	11.14	222.80	–	–	
Dry Matter,	88.86	1,777.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.59	131.80	–	–	
" Cellulose,	12.80	256.00	51.20	20	1 : 3.85
" Fat,	6.00	120.00	96.00	80	
" Protein (Nitrogenous Matter),	17.72	354.40	311.87	88	
Non-nitrogenous Extract Matter,	56.89	1,137.80	910.04	80	
	100.00	2,000.00	1,369.11	–	

Used in the seventh feeding experiment.

ON FODDER SUPPLY, AND ANALYSES OF FODDER ARTICLES.

On Fodder Supply.

The practice of raising a greater variety of valuable crops for green fodder deserves the serious consideration of farmers engaged in the dairy business, for it secures a liberal supply of healthy, nutritious fodder, at a time when hay becomes scarce and costly, and when it would be still a wasteful practice to feed an imperfectly matured green fodder corn. The frequently limited area of land fit for a remunerative production of grasses, and the not less recognized exhausted condition of a large proportion of natural pastures, makes it but judicious to consider seriously the means which promise, not only to increase, but also to cheapen, the products of the dairy.

A liberal introduction of reputed forage crops into farm operations has, everywhere in various directions, promoted the success of agricultural industry. The desirability of introducing a greater variety of fodder plants into our farm management is generally conceded. In choosing plants for that purpose, it seems advisable to select crops which would advantageously supplement our leading fodder crop (aside from the products of pastures and meadows), — the fodder corn and corn stover.

Taking this view of the question, the great and valuable family of leguminous plants, as clovers, vetches, lucerne, serradella, peas, beans, lupines, etc., is, in a particular degree, well qualified for that purpose. They deserve also a decided recommendation in the interest of a wider range for the introduction of economical systems of rotations, under various conditions of soil, and different requirements

of markets. Most of these fodder plants have an extensive root system, and, for this reason, largely draw their plant-food from the lower portion of the soil. The amount of stubble and roots they leave behind after the crop has been harvested is exceptionally large, and decidedly improves both the physical and chemical condition of the soil. The lands are consequently better fitted for the production of shallow-growing crops, as grains, etc. Large productions of fodder crops assist in the economical raising of general farm crops; although the area devoted to the cultivation of the latter is reduced, the total yield of the land is usually more satisfactory.

One of the foremost experts in stock-feeding, Julius Kühn of Halle, Germany, expressed the whole question in the following terse manner: "Much fodder, — much manure, large crops and more money in the end."

Each farmer ought to make his selection, from among the various fodder plants, to suit his individual resources and wants; yet, adopting this rule as his guide, he ought to make his selection on the basis that the crop which is capable of producing, for the same area, the largest quantity of nitrogen — containing food constituents, at the least cost, is, as a rule, the most valuable one for him.

Our prominent fodder plants may be classified, in regard to the relative proportion of their *nitrogenous* organic food constituents to their *non-nitrogenous* organic food constituents (nutritive ratio), in the following order: —

1.	Leguminous plants, clover, vetch, etc., . . .	1:2.2 to 1:4.5
2.	Grasses, ...	1:5.0 to 1:8.0
3.	Green corn, roots and tubers, ...	1:6.0 to 1:15.0

The value of an article of fodder may be stated from two different stand-points, — that is, with reference to its cost in the local market, and with reference to its nutritive feeding value.* The market price may be expressed by a definite sum for each locality; it depends on demand and supply in the market, and it is beyond the control of the individual farmer. The nutritive value, or, commonly called, food

* For details regarding estimation of nutritive ratio, see article on "Fodder and Fodder Analysis," Page 31-37, Fourth Annual Report.

value, of the article cannot be expressed by a definite sum; it varies with a more or less judicious application, and depends also, to a considerable degree, on its adaptation under varying circumstances.

To secure the most satisfactory returns from feeding our home-raised fodder crops, is as important a question as that of raising them in an economical manner. The question whether one or the other fodder mixture will prove, ultimately, under otherwise corresponding circumstances, the cheapest one, can only be answered intelligently when both the original cost of the feed consumed, and the value of the manurial residue subsequently obtained, are duly considered.

The composition of the various articles of food used in farm practice exerts a decided influence on the manurial value of the animal excretions, resulting from their use in the diet of different kinds of farm live-stock. The more potash, phosphoric acid, and, in particular, nitrogen, a fodder contains, the more valuable will be, under otherwise corresponding circumstances, the manurial residue left behind, after it has served its purpose as a constituent of the food consumed.

As the financial success in most farm management depends, in a considerable degree, on the amount, the character and the cost of the manurial refuse material secured in connection with the special farm industry carried on, it needs no further argument to prove that the relations which exist between the composition of the fodder and the value of the manure resulting deserves the careful consideration of the farmer, when devising an efficient and at the same time an economical diet for his live-stock.

Fodder Corn and Corn Ensilage.

In the fourth annual report on the work of the Experiment Station, it was stated that a series of tests carried out with plants taken from our fields had demonstrated the fact that the vegetable matter in the variety of corn on trial (Clark) had increased from fifty to one hundred per cent. in actual weight between the time of the first appearance of the tassel and the beginning of the kernels to glaze. It was found

that the same variety of corn, raised under fairly corresponding circumstances, as far as the general character of the soil and the mode of cultivation are concerned, contained, in one hundred weight parts, at the time of the *first appearance of the tassel*, from *twelve to fifteen* weight parts of dry vegetable matter, and from *eighty-five* to *eighty-eight* parts of water; while at the time of the *beginning of the glazing of the kernels*, the former was noticed to vary from *twenty-three* to *twenty-eight* weight parts, and the water from *seventy-seven* to *seventy-two*. These results of our investigation left no doubt concerning the fact that our green fodder corn, at the time of the beginning of the glazing of the kernels, contained nearly twice as much vegetable matter per ton weight of corn as at the time of the appearance of the tassels.

This feature in the change of the composition of the fodder corn during its growth is not an exceptional one; similar changes are noticed in all our farm plants. Our observations in this direction were reported for the purpose of furnishing some more definite numerical values for the consideration of our practical farmers. As long as the vital energy of an annual plant is still essentially spent in the increase of its size, as a rule, but a comparatively small amount of valuable organic compounds, as starch, sugar, etc., accumulate within its cellular tissue. The comparative feeding value of the same kind of fodder plants, or any particular part of such plants, is not to be measured by its size, but by the quantity of valuable organic nitrogenous and non-nitrogenous constituents stored up in its cellular system. The larger or smaller amount of dry vegetable matter left behind from a given weight of samples of the same kind, of a fodder plant of a corresponding stage of growth, indicates, in the majority of cases, their respective higher or lower economical value for feeding purposes. Agricultural chemists, for this reason, usually begin their examination of a fodder plant with a test for the determination of the amount of dry vegetable matter left behind when carefully brought to a constant weight at a temperature not exceeding 110° C.

The amount of vegetable matter in a given weight of green fodder corn, cut at the *beginning of the glazing of the kernels*,

is known to be not only nearly *twice* as large, as compared with that contained in an *equal weight of green fodder corn* when just showing the *tassels*, but it is also known to be, pound for pound, more nutritious; for it contains more starch, more sugar, more of valuable nitrogenous matter, etc.

Accepting these views as correct, our silos have been filled, for several years past, with fodder corn which had just reached the stage of growth when the kernels begin to glaze over. The condition of the plants along the outside of the corn-field served as guides. These plants are, as a rule, more advanced in growth than those in the more protected parts of the field.

The fodder corn, when cut for the silo, Sept. 9, began to acquire a slightly yellowish tint along the outside of the field, yet was still green and succulent in the interior parts; the kernels were soft, their contents somewhat milky, and their outside just beginning to glaze.

A silo, five by fourteen feet, inside measure, and eleven feet deep, was filled to a depth of from eight to nine feet, as fast as the cut corn, 1¼ to 1½ inches long, could be supplied and tramped down. As soon as the amount of corn assigned for that silo (9 tons) was filled in, the surface was carefully covered with tarred paper and tight-fitting boards, in the same manner as in the case of the first silo, and at once pressed down with twenty-five barrels of sand. A maximum registering thermometer was safely buried at a depth of about three feet in the mass, to record the highest temperature which the latter would reach during the time of keeping the silo closed.

The silo was re-opened for feeding, Jan. 4, 1887. The record of the maximum thermometer buried in the centre of the silo showed 97° F., indicating but a slight increase in temperature, as compared with the temperature on the day when filled. The ensilage was of a good quality. A comparison with the composition of the green fodder corn which served for its manufacture, shows the usual changes noticed in a silo which has been filled at once and closed carefully without any material delay, to prevent a more serious heating up of its contents; namely, a decrease in nitrogenous matter and crude cellulose, and an increase in

fatty acids and soluble non-nitrogenous extract matter. The nutritive ratio of the fodder corn was but slightly altered.

A sample of the corn ensilage, taken from two feet below the surface, near the centre of the silo, contained 32.46 parts of dry matter, 0.0185 parts of actual ammonia, and required 0.659 milligrams of sodium oxide for the neutralization of its acids (acetic and lactic acids). An average sample of the ensilage served for the analysis below reported.

I. Green Fodder Corn, used for Ensilage in 1886 (Clark variety).
II. Corn Ensilage, obtained from the above-described Fodder Corn.

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	70.27	71.60
Dry Matter,	29.73	28.40
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	5.24	3.32
" Cellulose,	24.50	18.52
" Fat,	3.38	6.07
" Protein (Nitrogenous Matter),	8.36	7.78
Non-nitrogenous Extract Matter,	58.52	64.31
	100.00	100.00

Analysis of Green Fodder Corn and Corn Ensilage, with Reference to Fertilizing Constituents.

	Pounds per Hundred.	
	Green Fodder Corn.	Corn Ensilage.
Moisture at 100° C.,	70.27	71.60
Phosphoric acid (6 cents per pound),	0.13	0.14
Ferric oxide,	–	0.02
Magnesium oxide,	0.05	0.09
Calcium oxide,	0.18	0.10
Potassium oxide (4¼ cents per pound),	0.36	0.33
Sodium oxide,	0.05	0.05
Nitrogen (17 cents per pound),	0.41	0.36
Insoluble matter,	0.45	0.04
Valuation per 2,000 pounds,	$1 86	$1 68

The corn was raised upon land which had been for several years fertilized with ground bone and muriate of potash, 600 pounds of ground bone and 200 pounds of muriate of potash being applied.

The ensilage has been used with satisfactory results in the feeding experiments with milch cows, I., which are described in the beginning of this report.

The silo was filled again with fodder corn for ensilage, Sept. 5, 1887. The same rules were carried out on that occasion as in the preceding year. A maximum and a minimum recording thermometer has been buried several feet below the surface of the cut corn, to study changes in temperature, etc. The ensilage will be used for a repetition of our feeding experiments, under some modified circumstances.

1. FODDER OATS.

[Grown at the Experiment Station on well-manured land. Collected July 5, 1886 (in bloom).]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture when collected,	78.61	1,572.00	–	–	
Dry Matter when collected,	21.39	427.80	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.38	147.60	–	–	
" Cellulose,	33.12	662.40	–	–	
" Fat,	2.02	40.40	18.58	46	1 : 13.02
" Protein (Nitrogenous Matter),	7.10	142.00	80.94	57	
Non-nitrogenous Extract Matter,	50.38	1,007.60	1,007.60	100	
	100.00	2,000.00	1,107.12	–	

2. FODDER OATS.

[Grown at the Experiment Station on well-manured land. Collected July 13, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture when collected,	71.18	1,423.60	–	–	
Dry Matter when collected,	28.82	576.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.99	139.80	–	–	
" Cellulose,	32.83	656.60	–	–	
" Fat,	2.44	48.80	22.45	46	1 : 13.32
" Protein (Nitrogenous Matter),	7.05	141.00	80.38	57	
Non-nitrogenous Extract Matter,	50.69	1,013.80	1,013.80	100	
	100.00	2,000.00	1,116.63	–	

ROWEN (HAY).

[Raised on Station Grounds, 1887. Contained a liberal admixture of Red Clover.]

	Per cent.
Moisture at 100° C.,	8.84
Dry Matter,	91.16
	100.00
Analysis of Dry Matter.	
Crude Ash,	10.50
" Cellulose,	29.46
" Fat,	3.05
" Protein (Nitrogenous Matter),	13.20
Non-nitrogenous Extract Matter,	43.79
	100.00

Fertilizing Ingredients of Rowen.

	Per cent.
Moisture at 100° C.,	8.840
Phosphoric acid,	.364
Potassium oxide,	2.860
Nitrogen,	1.930
Sodium oxide,	.122
Calcium oxide,	.853
Magnesium oxide,	.197
Ferric oxide,	.057
Insoluble Matter,	2.178

SERRADELLA.

[Grown at the Experiment Station. Collected when in bloom, Aug. 4, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture when collected,	84.60	1,692.00	–	–	
Dry Matter when collected,	15.40	308.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	11.85	237.00	–	–	
" Cellulose,	26.21	524.20	–	–	
" Fat,	2.65	53.00	31.80	60	1 : 4.07
" Protein (Nitrogenous Matter),	17.75	355.00	223.65	·63	
Non-nitrogenous Extract Matter,	41.54	830.80	830.80	100	
	100.00	2,000.00	1,086.25	–	

Analysis of Serradella, with Reference to Fertilizing Constituents.

	Per cent.
Moisture at 100° C.,	10.54
Phosphoric acid (6 cents per pound),	.90
Potassium oxide (4¼ cents per pound),	2.60
Magnesium oxide,	.39
Calcium oxide,	2.63
Sodium oxide,	.55
Nitrogen (17 cents per pound),	2.54
Insoluble Matter,	.21
Valuation per 2,000 pounds,	$11 93

This plant has been described in previous reports as a valuable fodder plant, adapted to moist, sandy lands. Its feeding value has been tested at the Station during the past year.

WHITE DAISY (LEUCANTHEMUM VULGARE).

(Dried.)

	Per cent.
Moisture at 100° C.,	9.65
Dry Matter,	90.35
	100.00

Analysis of Dry Matter.

Crude Ash,	7.05
" Cellulose,	36.09
" Fat,	2.32
" Protein (Nitrogenous Matter),	7.68
Non-nitrogenous Extract Matter,	46.86
	100.00

Fertilizing Ingredients of White Daisy.

Moisture at 100° C.,	9.65
Phosphoric acid,	.435
Potassium oxide,	1.253
Nitrogen,	1.110
Sodium oxide,	1.636
Calcium oxide,	1.302
Magnesium oxide,	.198
Insoluble Matter,	.279
Valuation per 2,000 lbs.,	$5 36

"PRIDE OF THE NORTH" CORN.

[Raised at the Experiment Station, 1886.]

Average length of ear, seven inches, containing fourteen rows of kernels. The ear was well filled-out at the butt. Average weight of the corn and cob was six ounces, consisting of 84 per cent. of kernels and 16 per cent. of cob. Average weight of kernels, .24 gramme.

	Per cent.
Moisture at 100° C.,	8.75
Dry Matter,	91.25
	100.00

Analysis of Dry Matter.

Crude Ash,	1.59
" Cellulose,	2.54
" Fat,	4.34
" Protein (Nitrogenous Matter),	12.05
Non-nitrogenous Extract Matter,	79.48
	100.00

The seed corn came from the Department of Agriculture at Washington, D. C.; it had been obtained from Minnesota. The corn was raised at the Station lands in good cultivation, with 600 pounds of ground bones and 200 pounds of muriate of potash per acre, as fertilizer. The plant belongs to the "Dent" variety, and deserves recommendation for trial in our section of the State. The composition of the kernels is above the average. The stalks are, however, somewhat harder than many of our local varieties.

"WESTERN DENT" CORN.

[Sent on from Sunderland, Mass.]

	Per Cent.	
	Ears.	Stover.
Moisture at 100° C.,	10.20	6.67
Dry Matter,	89.80	93.33
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	1.47	4.17
" Cellulose,	1.86	35.44
" Fat,	4.72	1.71
" Protein (Nitrogenous Matter),	9.31	6.63
Non-nitrogenous Extract Matter,	82.64	52.05
	100.00	100.00

The above-stated corn was raised, according to reports received, on excellent soil in "Sunderland Meadows;" four cords of barnyard manure and 150 pounds of a phosphatic fertilizer per acre had been applied.

6 stalks, well air-dried, weighed	2 lbs., 0 oz.
6 ears, well air-dried, weighed	2 " 8 "

The average length of the ear was seven and one-half inches. It contained twelve rows of kernels, and its average weight amounted to six and one-half ounces; 85.6 per cent. kernels, and 14.4 per cent. cob.

"CANADA" CORN (KERNELS).

[Sent on from North Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	9.76
Dry Matter,	90.24
	100.00

Analysis of Dry Matter.

Crude Ash,	1.77
" Cellulose,	2.18
" Fat,	6.39
" Protein (Nitrogenous Matter),	11.50
Non-nitrogenous Extract Matter,	78.16
	100.00

The above-stated corn was grown on heavy, dry loam, fertilized with nine cords of barnyard manure and hog manure to the acre.

8 ears, well air-dried, weighed	1 lb., 13 oz.
5 stalks, well air-dried, weighed	1 " 4 "

The average length of the ear was six and one-third inches. It contained eight rows of kernels, and its average weight amounted to three and three-fourths ounces; 85.07 per cent. kernels, and 14.93 per cent. cob. The average weight of a kernel was .34 gramme. The yield per acre at harvest time was 5,063.5 pounds of ears.

ADAM'S WHITE CORN.

[Sent on from North Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	10.96
Dry Matter,	89.04
	100.00

Analysis of Dry Matter.

Crude Ash,	1.56
" Cellulose,	2.22
" Fat,	5.37
" Protein (Nitrogenous Matter),	8.88
Non-nitrogenous Extract Matter,	81.97
	100.00

The above-stated corn was grown on light, sandy loam, fertilized with four cords of barnyard manure and thirty-five bushels of unleached ashes per acre.

6 ears, well air-dried, weighed	2 lbs., 2 oz.
6 stalks, well air-dried, weighed	1 " 6 "

The average length of ear was eight and one-quarter inches. It contained twelve rows of kernels, and its average weight amounted to six ounces; 72.2 per cent. kernels, and 27.8 per cent. cob. The average weight of a kernel was .25 gramme. The yield per acre at harvest time was 4,050 pounds of ears.

BROOM-CORN SEED (UNGROUND).

[Sent on from North Hadley, Mass.]

	Per cent.
Moisture at 100° C.,	14.10
Dry Matter,	85.90
	100.00

Analysis of Dry Matter.

Crude Ash,	2.35
" Cellulose,	8.34
" Fat,	4.05
" Protein (Nitrogenous Matter),	11.21
Non-nitrogenous Extract Matter,	74.05
	100.00

BROOM-CORN SEED MEAL.

70.26 per cent. passed screen 144 mesh to square inch.

[Sent on from North Hadley, Mass.]

	Per cent.
Moisture at 100° C.,	13.54
Dry Matter,	86.46
	100.00

Analysis of Dry Matter.

Crude Ash,	2.43
" Cellulose,	8.00
" Fat,	4.13
" Protein (Nitrogenous Matter),	11.14
Non-nitrogenous Extract Matter,	74.30
	100.00

BROOM-CORN WASTE (STALKS)

[Sent on from North Hadley, Mass.]

	Per cent.
Moisture at 100° C.,	8.70
Dry Matter,	91.30
	100.00

Analysis of Dry Matter.

Crude Ash,	4.88
" Cellulose,	39.25
" Fat,	1.00
" Protein (Nitrogenous Matter),	6.78
Non-nitrogenous Extract Matter,	48.09
	100.00

Fertilizing Ingredients of Broom-Corn Waste.

Moisture at 100° C.,	10.374
Phosphoric acid (6 cents),	.460
Potassium oxide (4½ cents),	1.858
Nitrogen (12 cents),	.870
Calcium oxide,	.242
Magnesium oxide,	.170
Insoluble Matter,	.997
Valuation per ton of 2,000 pounds,	$4 13

PEA MEAL.

[Sent on from Springfield, Mass.]

63.88 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.85	177.00	–	–	
Dry Matter,	91.15	1,823.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	2.94	58.80	–	–	
" Cellulose,	19.42	388.40	–	–	
" Fat,	1.67	33.40	26.72	80	1 : 2.98
" Protein (Nitrogenous Matter),	20.95	419.00	368.72	88	
Non-nitrogenous Extract Matter,	55.02	1,100.40	1,034.38	94	
	100.00	2,000.00	1,429.82	–	

The above material comes from parties engaged in the manufacture of split peas. It is evidently a mixture of ground peas with a liberal admixture of ground skins of peas. The article is offered in Springfield at twenty dollars per ton. The well-known highly nutritious quality of the peas renders a trial advisable.

Analysis of Pea Meal, with Reference to its Fertilizing Constituents.

	Per cent
Moisture at 100° C.,	8.85
Ferric oxide,	0.03
Phosphoric acid (6 cents per pound),	0.82
Magnesium oxide,	0.30
Calcium oxide,	0.30
Potassium oxide (4¼ cents per pound),	0.99
Sodium oxide,	0.62
Nitrogen (17 cents per pound),	3.08
Insoluble matter,	0.12
Valuation per 2,000 pounds,	$12 31

GLUTEN MEAL (Chicago).

[Bought at Springfield, Mass.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.04	200.80	–	–	
Dry Matter,	89.96	1,799.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	.78	15.60	–	–	
" Cellulose,	4.45	89.00	30.26	34	
" Fat,	9.34	186.80	141.97	76	1 : 2.27
" Protein (Nitrogenous Matter),	34.67	693.40	589.39	85	
Non-nitrogenous Extract Matter,	50.76	1,015.20	954.29	94	
	100.00	2,000.00	1,715.91	–	

WHEAT BRAN.

[Amherst Mill.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.38	207.60	–	–	
Dry Matter,	89.62	1,792.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.92	138.40	–	–	
" Cellulose,	14.26	285.20	57.04	20	1 : 4.17
" Fat,	4.81	96.20	76.96	80	
" Protein (Nitrogenous Matter),	16.25	325.00	286.00	88	
Non-nitrogenous Extract Mattter,	57.76	1,155.20	924.16	80	
	100.00	2,000.00	1,344.16	–	

WHEAT BRAN (1886).

[Fine Ground.]

94.95 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.20	244.00	–	–	
Dry Matter,	87.80	1,756.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.33	146.60	–	–	
" Cellulose,	10.92	218.40	43.68	20	1 : 3.16
" Fat,	2.80	56.00	44.80	80	
" Protein (Nitrogenous Matter),	19.79	395.80	348.30	88	
Non-nitrogenous Extract Matter,	59.16	1,183.20	946.56	80	
	100.00	2,000.00	1,383.34	–	

Analysis of Wheat Bran, with reference to Fertilizing Constituents.

	Per cent.
Moisture at 100° C.,	9.54
Phosphoric acid (6 cents per pound),	1.89
Magnesium oxide,	0.54
Calcium oxide,	0.14
Potassium oxide, (4¼ cents per pound),	1.09
Sodium oxide,	0.06
Nitrogen (17 cents per pound),	2.83
Insoluble matter,	0.64
Valuation per 2,000 pounds,	$12 82

WHEAT MIDDLINGS.

[Amherst Mill.]

99.51 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.54	190.80	–	–	
Dry Matter,	90.46	1,809.20	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	4.47	89.40	–	–	
" Cellulose,	5.64	112.80	22.56	20	1 : 4.07
" Fat,	6.00	120.00	96.00	80	
" Protein (Nitrogenous Matter),	19.45	389.00	342.32	88	
Non-nitrogenous Extract Matter,	64.44	1,288.80	1,031.04	80	
	100.00	2,000.00	1,491.92	–	

Analysis of Wheat Middlings, with reference to Fertilizing Constituents.

	Per cent.
Moisture at 100° C.,	12.20
Phosphoric acid (6 cents per pound),	2.84
Ferric oxide,	.02
Magnesium oxide,	.91
Calcium oxide,	.14
Potassium oxide (4¼ cents per pound),	1.62
Sodium oxide,	.09
Nitrogen (17 cents per pound),	2.78
Insoluble matter,	.13
Valuation per 2,000 pounds,	$14 24

CORN MEAL.

92.93 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	11.68	233.60	–	–	
Dry Matter, ...	88.32	1,766.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	1.56	31.20	–	–	
" Cellulose, . . .	2.44	48.80	16.59	34	
" Fat, ...	4.73	94.60	71.89	76	1 : 7.50
" Protein (Nitrogenous Matter), . .	10.34	206.80	175.78	85	
Non-nitrogenous Extract Matter, ...	80.93	1,618.60	1,121.48	94	
	100.00	2,000.00	1,385.74	–	

CORN MEAL.

[Amherst Mill.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	12.98	259.60	–	–	
Dry Matter, ...	87.02	1,740.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	1.75	35.00	–	–	
" Cellulose, . . .	3.42	68.40	23.26	34	
" Fat, ...	5.08	101.60	77.22	76	1 : 10.01
" Protein (Nitrogenous Matter), . .	10.07	201.40	171.19	85	
Non-nitrogenous Extract Matter, ...	79.68	1,593.60	1,497.98	94	
	100.00	2,000.00	1,769.65	–	

CORN MEAL.

[Amherst Mill.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	13.18	263.60	–	–	
Dry Matter,	86.82	1,736.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.57	31.40	–	–	
" Cellulose,	3.56	71.20	24.21	34	
" Fat,	4.86	97.20	73.87	76	1 : 9.33
" Protein (Nitrogenous Matter),	10.72	214.40	182.24	85	
Non-nitrogenous Extract Matter,	79.29	1,585.80	1,490.65	94	
	100.00	2,000.00	1,770.97	–	

CRACKED CORN (Chits Removed).

[Sent on from North Hadley, Mass.]

	Per cent.
Moisture at 100° C.,	13.58
Dry Matter,	86.42
	100.00
Analysis of Dry Matter.	
Crude Ash,	2.64
" Cellulose,	3.15
" Fat,	4.06
" Protein (Nitrogenous Matter),	10.99
Non-nitrogenous Extract Matter,	79.16
	100.00

CHIT CORN MEAL.

80.65 per cent. passed screen 144 Mesh to square inch.

[Sent on from North Hadley, Mass.]

	Per cent.
Moisture at 100° C.,	12.32
Dry Matter,	87.68
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	2.08
" Cellulose,	3.92
" Fat,	5.74
" Protein (Nitrogenous Matter),	10.26
Non-nitrogenous Extract Matter,	78.00
	100.00

ENSILAGE OF SWEET CORN.

[Sent on from Marblehead, Mass.]

Analysis of Dry Matter.

	Per cent.
Crude Ash,	5.66
" Cellulose,	24.21
" Fat,	5.19
" Protein (Nitrogenous Matter),	10.10
Non-nitrogenous Extract Matter,	54.84
	100.00

The general appearance of the ensilage was good. The small amount of soluble non-nitrogenous matter, in presence of a comparatively large amount of crude nitrogenous matter and of crude cellulose, seems to indicate a considerable destruction of non-nitrogenous matter (sugar, starch, etc.) during the keeping of the corn in the silo. The composition of this sample of ensilage of sweet corn resembles that obtained from corn in the tassel. A comparison of the above analysis with some of the analyses of the dry vegetable matter of corn ensilage, produced at the Experiment Station during previous years, suggests that conclusion.

ANALYSES OF FINE SALT.

[I. and II. sent on from Florida, Berkshire County, Mass. III. sent on from Springfield, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	3.280	4.591	4.616
Sodium chloride,	95.091	94.012	94.236
Calcium sulphate,	1.487	1.177	0.999
Calcium chloride,	0.032	0.143	0.071
Magnesium chloride,	0.075	0.049	0.026
Matter insoluble in water (largely carbonates of lime and magnesia),	0.035	0.028	0.052
Salicylic acid,	0.	0.	trace.
	100.000	100.000	100.000

The above-described samples of salt have been offered of late in our markets as "dairy salt," judging from communications received. As the recent introduction into our markets of various brands of salt from new salt works in western New York imparts a particular interest to the question of what constitutes a good dairy salt, a short discussion of that question may not be without interest in connection with the above analyses.

There are three sources of supply for the manufacture of salt; namely, sea water, brines and rock salts. None of them yield by any current mode of manufacture a chemically pure article of sodium chloride; all three may be successfully turned to account for the manufacture of the various brands of salt in our market.

Local circumstances control the selection of the particular source of supply; and, as the particular fitness of salt for different domestic applications, as meat-packing, family use and dairy, depends not only on a fairly good chemical composition, but also to a considerable degree on a suitable mechanical condition, it is quite obvious that the selection of the mode of manufacture has to be made with reference to the general character and the quality of the source on hand, and to the kind of salt desired.

Our home-manufactured salt — "coarse," "fine" and "dairy salt" — has been produced, until of late, almost entirely from natural brines, sea-water excluded. All natural brines contain more or less of foreign saline admixtures. Most prominent among these are the sulphates of lime and magnesia, and the chlorides of calcium and magnesium.

The general character and the industrial value of different brines, considering concentration equally favorable, depend as a rule not so much on the total amount of foreign saline substances present, as on the relative proportion of the above-stated foreign admixtures.

The same circumstances apply with equal force to the salt produced. The less chlorides of calcium and magnesium a salt contains, the better will be considered its quality, from a commercial stand-point. The presence of sulphate of lime, within certain limits, is far less objectionable.

A salt which contains but one-fourth of one per cent. of

the chlorides of magnesium and of calcium, might prove highly objectionable to the dairyman, on account of its unpleasantly bitter saline taste; while the sulphate of lime rarely amounts to less than one and one-quarter per cent. in the best-reputed brands of dairy salts, home and foreign.

A detailed statement of the exact amount of each of the above-mentioned foreign saline admixtures is for this reason needed, to render a decision possible regarding the relative merits of the various brands of salt offered for sale, as far as a desirable composition is concerned.

The most common cause of injuring the composition of salt, for dairy purposes in particular, is a too liberal use of lime during its manufacture, to secure a desirable white color and a fine granulation of the salt produced.

The natural consequence of that course of operation is an alkaline reaction of the salt, — a most objectionable quality of a dairy salt, for it hastens on the decomposition of the butter.

The peculiar nature of the products of the dairy, — butter and cheese, — as well as the unusual pecuniary risks involved in their successful manufacture, renders it necessary that only first-class articles of salt should be applied for dairy purposes. The fitness of any of the various brands of salt in our markets for dairy use is not restricted to those obtained from any particular natural source or locality, but depends entirely upon a suitable good chemical composition, and a suitable mechanical condition.

A good dairy salt ought to be of a neutral reaction, and of a pure saline taste; free from offensive odor, and without any stain of color; of a properly reduced size to favor a speedy solution; and, what is scarcely of less importance, free from colored specks. As the application of dairy salt in form of saturated solutions enables, with but little trouble, the removal of insoluble foreign admixtures, this mode of using salt in the dairy industries, whenever admissable, deserves commendation.

To produce an article of the above description requires an extra exertion on the part of the manufacturer, and necessitates thus additional expenses, as compared with the average brands of "common fine" and the ordinary "coarse or

solar salts," neither of which, as a general rule, answers to the previous description.

A dairy salt, originally good, may become objectionable in consequence of a subsequent careless storing amidst strong-smelling articles of merchandise, etc., or in barns.

Judging the above samples of "dairy salt" by the customary commercial standard of composition previously explained, it will be noticed that sample I. is preferable to sample II., although its total amount of foreign saline admixture is larger than in samples II. and III. The last-named sample would rank next, if it did not contain some salicylic acid.

None of the above three samples can claim to rank with the better brands of "dairy salt" in our markets.

The presence of an exceptional amount of carbonate of lime in all of them impairs greatly their fitness for dairy purposes A good salt may not improve materially an otherwise carelessly manufactured butter or cheese, yet a lower grade of fine salt will invariably destroy the keeping quality of a good butter and cheese.

The addition of salicylic acid as a preservative is strongly condemned by good authorities in sanitary matters.

DAIRY SALT.

[Sent on from Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	.145
Sodium chloride,	98.520
Calcium sulphate,	1.009
Calcium chloride,	.189
Magnesium chloride,	.065
Insoluble matter (chiefly carbonate of magnesia and sand),	.072

ROCK SALT.

[From the Retsof Salt Mines at Piffard, Livingston County, New York. Sent on from Springfield, Mass.]

	Per cent.
Moisture at 100° C.,	2.60
Calcium sulphate,	0.42
Calcium chloride,	0.33
Magnesium chloride,	0.01
Sodium chloride,	95.94
Insoluble matter,	0.70
	100.00

This article has been, of late, introduced into our market in lump form, to take the place of the English lump salt for stock feeding. The sample sent on for examination was of a very fair quality, and compared very favorably with the former. Its selling price at Springfield, Mass., is stated: from 5 to 10 pounds, at $1\frac{1}{2}$ cents per pound; 100 pounds, at 75 cents; wholesale, per ton of 2,000 pounds, at $8.50; and in car-loads, one dollar less per ton.

SALT.

KIND AND SOURCE.	Moisture 100° C.	Sodium Chloride.	Calcium Sulphate.	Calcium Chloride.	Magnesium Chloride.	Sodium Sulphate.	Magnesium Sulphate.	Insoluble Matter.	Remarks.
Rock Salt of Pettite Ause, La.,	.330	98.882	.782	.004	.003	–	–	–	Sent on for Examination.
Rock Salt of Neyba, St. Domingo, W. I.,	.300	98.330	1.480	–	.090	.070	.070	–	
Solar Salt, Onondaga, N.Y.,	2.500	96.004	1.315	.092	.089	–	–	–	
Solar Salt, Hocking Valley, Ohio,	2.130	97.512	None.	.234	.089	–	–	–	
Solar Salt, Saginaw Valley, Mich.,	3.344	95.813	.316	.356	.140	–	–	–	
Solar Salt from Kansas,	4.950	93.060	1 220	–	.240	.350	.180	–	
Solar Salt, Lincoln County, Nebraska,	1.200	98.130	.250	–	.080	.390	None.	–	
Common Fine and Boiled Salt, Onondaga, N. Y.,	3.000	95.353	1.355	.155	.136	–	–	–	
Common Fine and Boiled Salt, Portsmouth, Mich.,	6.752	90.682	.805	.974	.781	–	–	–	
Common Fine and Boiled Salt, Mason City, Ohio,	3.470	95.789	–	.614	.041	–	–	–	
Dairy and Table Salt, Ashton's (English),	0.760	97.652	1.430	–	.060	–	.048	.050	
Onondaga Dairy Salt,	0.700	97.832	1.263	–	.037	.026	.023	.120	
Fine Salt, Bulletin 26, I.,	3.280	95.091	1.187	.032	.075	–	–	.035	
Fine Salt, Bulletin 26, II.,	4.591	94.012	1.177	.143	.049	–	–	.028	
Fine Salt, Bulletin 26, III.,	4.616	94.236	.999	.071	.026	–	–	.052	Salicylic Acid: Trace.
Dairy Salt, sent on from Amherst, Mass.,	0.145	98.520	1.009	.189	.065	–	–	.072	

FIELD EXPERIMENTS.

I. Field A. Fodder Corn Raised with Single Articles of Plant Food.

II. Field B Fodder Crops Raised with and without Complete Manure.

III. Field C. Experiments with Wheat, Vetch and Oats, Serradella and Southern Cow Pea.

IV. Field D. Experiments with Potatoes, Roots and Miscellaneous Crops.

FIELD EXPERIMENTS.

[Field A.]

1. Fodder Corn raised upon Underdrained Lands, partly fertilized with Single Articles of Plant Food, partly without the use of any Manurial Matter.

The field utilized for this experiment consists of ten adjoining plats, one-tenth of one acre each in size. The plats are five feet apart; the grounds between them are kept free from any growth, and receive no fertilizing ingredients of any description.

The entire field is surrounded by a tile drain, and each plat has a separate one through its centre. This terminates at its east end in a well which is connected with the surrounding drain.

The land was used, for several years previous to the establishment of the Experiment Station, in 1882, as a meadow for the production of hay. During the spring of 1883 it was planted with corn, for fodder corn, without the use of any fertilizer.

The same course of planting and cultivation was carried out during 1884, for the purpose of exhausting the soil, as far as practicable, for a remunerative cultivation of corn.

The crop raised in 1884 upon these plats of unmanured land left no doubt concerning their exhausted condition, as far as further successful cultivation of corn was concerned; for the entire yield of corn fodder amounted to 5,040 pounds, with a moisture of thirty per cent.

This condition of the soil encouraged the beginning of a special inquiry into the chemical and physical condition of our soil, as far as *its relation to the production of the corn crop is concerned*. With that end in view, the following

course was decided upon and carried out during the succeeding season (1885).

The entire field (A) was prepared, May 12, in a similar manner as in preceding years for the planting of corn (see Second Annual Report, page 81). All except Plat 6 were planted with (Clark) corn.

Plat No. 0, . . .	Thrown out of the experiment.
Plat No. 1, . . .	Twenty-five pounds of sodium nitrate (= to 4 lbs. of nitrogen).
Plat No. 2, . . .	Nothing.
Plat No. 3, . . .	Thirty pounds of dried blood (= to 4 lbs. of nitrogen).
Plat No. 4, . . .	Nothing.
Plat No. 5, . . .	Twenty-five pounds of ammonium sulphate (= to 5 lbs. of nitrogen).
Plat No. 6, . . .	Nothing. (Black Fallow.)
Plat No. 7, . . .	Fifty pounds of dissolved bone-black (= to 8.5 lbs. of available phosphoric acid).
Plat No. 8, . . .	Nothing.
Plat No. 9, . . .	Twenty-five pounds of muriate of potash (= to from 12 to 13 lbs. of potassium oxide).
Plat No. 10, . . .	48½ pounds of potash-magnesia sulphate (= to from 12 to 13 lbs. of potassium oxide).

The growth on the entire field was cut Sept. 5, and the product of each plat stooked by itself in the field for drying; it was housed Oct. 10, with the following results:—

1885.

PLAT.	Amount of Dry Corn Fodder obtained.	Fertilizer Applied.
No. 1, . .	480 lbs.	25 lbs. of sodium nitrate (= to 4 lbs. of nitrogen).
2, . .	310 "	Nothing.
3, . .	350 "	30 lbs. of dried blood (= to 4 lbs. of nitrogen).
4, . .	300 "	Nothing.
5, . .	360 "	25 lbs. of ammonium sulphate (= to 5 lbs. of nitrogen).
6, . .	—	Fallow.
7, . .	280 "	50 lbs. of dissolved bone-black (= to 8.5 lbs. of available phosphoric acid).
8, . .	250 "	Nothing.
9, . .	945 "	25 lbs. of muriate of potash (= to from 12 to 13 lbs. of potassium oxide).
10, . .	845 "	48½ lbs. of potash-magnesia sulphate (= to from 12 to 13 lbs. of potassium oxide).

Comparing these results with those obtained in the previous year, where the products of the various plats were practically of a corresponding weight (458 lbs. each), it was noticed that *the application of potash compounds alone, muriate of potash leading* (see Plats No. 9 and 10), *had exerted a marked effect* on the *quantity* and the *quality* of the corn fodder raised, increasing the previous annual yield not less than one hundred per cent. above that of the preceding year (1884).

The amount of corn fodder raised on Plat No. 1, which received nitrate of soda, had exceeded but slightly (22 lbs.) that of the previous season; while the application of blood, ammonium sulphate and phosphoric acid, had not prevented a considerable falling off. The yield of corn fodder of fertilized and unfertilized plats was practically the same in Plats 1 to 8.

In sight of these facts, it seemed but justifiable to conclude that a *deficiency of the soil in available potash had controlled, in our case, more than that of any other essential article of plant food, the final yield of the crop.*

As the cultivation of grasses and fodder corn affects the manurial resources of the soil in a similar direction, by abstracting approximately one part of phosphoric acid to four parts of potash, it is but a natural result that a soil which originally did not contain much more of available potash than of available phosphoric acid, must become unproductive before the latter is exhausted. In case circumstances necessitate a direct succession of these two crops, it is well to remember that fact, and to provide against a failure by applying to the soil liberally, in particular, potash compounds in some form or other. Muriate of potash deserves recommendation.

To verify the above conclusion, the experiment was continued during the year 1886, with the *sole modification of increasing on each fertilized plat the particular fertilizing ingredients to twice the amount used in the preceding year.*

The plats were thoroughly ploughed and harrowed May 15, 1886. The fertilizers were sown broadcast in each case,

and slightly harrowed in before planting the corn, in rows, May 21 and 22 (Clark's variety). The rows were three feet three inches apart. The seeds were dropped from twelve to fourteen inches apart, and six to eight kernels in a place. The mode of planting and the subsequent treatment of the crop was in every way corresponding to the course adopted in the two preceding years. The young plants appeared uniform and healthy looking, in all plats, June 1. They turned, however, to a pale green color by June 28, with the exception of those on Plats 9 and 10. The latter were still of a dark green color Sept. 11, when the entire crop was cut and stooked in the field. The corn growing on Plats 1 to 8, inclusive, had reached, at the end of the season, a height of from two to four feet, and showed only here and there a partially filled ear; it was badly dried up and unhealthy looking when cut. The plants grown upon Plats 9 and 10 had reached a height of from five to eight feet; the stalks and leaves were still succulent when cut, and the ears pretty well formed throughout the plats, but small, and the kernels scarcely beginning to glaze.

The weight of the corn fodder raised upon each plat was ascertained Oct. 23, when the crop was housed. The subsequent statement contains the results of the experiment. The weights of the corn fodder are stated with reference to the same state of moisture (from 45 to 50 per cent.) as in the preceding year, to allow a comparison of the results.

1886.

PLAT.	Amount of Dry Corn Fodder obtained.	Fertilizer Applied.
No. 1, . .	430 lbs.	50 lbs. of sodium nitrate (= to 7 to 8 lbs. of nitrogen).
2, . .	250 "	Nothing.
3, . .	310 "	60 lbs. of dried blood (= to 7 to 8 lbs. of nitrogen).
4, . .	250 "	Nothing.

1886.

PLAT.	Amount of Dry Corn Fodder obtained.	Fertilizer Applied.
No. 5, . .	280 lbs.	50 lbs. of ammonium sulphate (= to 10 lbs. of nitrogen).
6, . .	–	Fallow.
7, . .	255 "	100 lbs. of dissolved bone-black (= to 17 lbs. available phosphoric acid).
8, . .	195 "	Nothing.
9, . .	840 "	50 lbs. of muriate of potash (= to 25 lbs. of potassium oxide).
10, . .	895 "	97 lbs. of potash-magnesia sulphate (= to 25 lbs. of potassium oxide).

These results, compared with those of the previous year, show still a falling off in yield in all plats, notwithstanding a decided increase in the various single manurial substances applied on Plats 1, 3, 5, 7, 9 and 10. The yield of the fertilized Plats 1, 3, 5 and 7 during 1886 was less than that of the unfertilized plats in 1885. The good service of *potash compounds* as the *sole fertilizer was still as striking as in the two preceding years.*

1887.

The examination into the condition of "Field A," as far as its store of available plant food is concerned, was continued during the past year, with a view to showing, if possible, still more decidedly, that a serious exhaustion of the soil in available potassa, in particular, was the leading cause of a reduced production of corn fodder. To secure that end the following course has been pursued: —

The various plats were ploughed and harrowed during the second week of May. Plats 2, 4 and 8, which in previous years had been planted with corn without receiving any fertilizing ingredients, were used again for the raising of corn fodder, and left unfertilized as before. Plats 1, 3, 5, 7, 9 and 10 were fertilized broadcast before planting the corn. The mode of planting and the subsequent treatment of the crop was the same as in preceding years. No. 1, which for several years in succession had received as a fertilizer but from 4 to 8 pounds of nitrogen in form of nitrate of soda, was fertilized with a mixture of 50 pounds

of nitrate of soda (= 7 to 8 pounds of nitrogen) and 50 pounds of muriate of potash (= 25 pounds of potassium oxide).

No. 3, for several years in succession fertilized with from 4 to 8 pounds of nitrogen in form of dried blood, was treated with a mixture of 60 pounds of dried blood (=7 to 8 pounds of nitrogen) and 100 pounds of dissolved bone-black (= 16 to 17 pounds of available phosphoric acid).

No. 5, for several years in succession fertilized with 4 to 10 pounds of nitrogen in form of sulphate of ammonia, received as fertilizer a mixture of 50 pounds of ammonium sulphate (= 10 pounds of nitrogen) and 97 pounds of potash-magnesia sulphate (= 25 pounds of potassium oxide).

No. 7, for two succeeding years fertilized with from 8 to 16 pounds of available phosphoric acid, was treated with a mixture of 100 pounds of dissolved bone-black (= 16 to 17 pounds available phosphoric acid) and 50 pounds of muriate of potash (= 25 pounds potassium oxide).

No. 9 was fertilized, as in preceding years, with nothing but muriate of potash, of which 50 pounds were applied (=25 pounds potassium oxide), the same quantity previously used (1886).

No. 10, in preceding years fertilized with from 12 to 25 pounds of potassium oxide in form of potash-magnesia sulphate, received a mixture of 97 pounds of potash-magnesia sulphate (= 25 pounds potassium oxide) and 60 pounds of dried blood (= 7 to 8 pounds nitrogen).

The corn (Clark) was planted, in the same manner as in the preceding years, May 23. The crop upon the entire field looked uniform and healthy until the middle of July. Subsequently a gradual change in appearance became noticeable. The growth upon the plats which had either received no fertilizer, or one which did not contain potash, turned yellowish, ceased to grow, and produced a few imperfect ears; while, upon those plats which had been fertilized with a material containing potash, it retained its healthy appearance, reached its normal height and produced a liberal number of perfect ears. The entire crop was cut and stooked in the field Sept. 15; it was housed, after being weighed, Oct. 17.

The following tabular statement of our field results for three succeeding years needs scarcely any further explanation. The beneficial influence of a potash supply on the yield of fodder, upon our experimental plats, is in every instance unmistakable ; while the application of a liberal supply of phosphoric acid and nitrogen, either separately or combined, on the whole, does not materially affect the annual yield, when compared with the unfertilized plats.

The investigation will be continued, with some modifications, to serve as an illustration concerning the effect of a one-sided exhaustion of farm lands, and to assist in pointing out some practical lessons for an economical management of the latter.

FIELD "A."

[1882, a meadow; 1883, planted with "Longfellow" corn; 1884, 1885, 1886 and 1887, planted with "Clark" corn.]

NUMBER OF PLAT.	FERTILIZERS APPLIED.			YIELD OF DRY FODDER CORN.		
	1885.	1886.	1887.	1885.	1886.	1887.
PLAT 1, . .	25 lbs. sodium nitrate (=4 lbs. nitrogen).	50 lbs. sodium nitrate (=7 to 8 lbs. nitrogen).	50 lbs. sodium nitrate (=7 to 8 lbs. nitrogen), and 50 lbs. muriate of potash (=25 lbs. potassium oxide), ...	Lbs. 480	Lbs. 430	Lbs. 720
PLAT 2, . .	Nothing, ...	Nothing, ...	Nothing, ...	310	250	165
PLAT 3, . .	30 lbs. dried blood (=4 lbs. nitrogen).	60 lbs. dried blood (=7 to 8 lbs. nitrogen).	60 lbs. dried blood (=7 to 8 lbs. nitrogen), 100 lbs. dissolved bone-black (=17 lbs. available phosphoric acid), ...	350	310	240
PLAT 4, . .	Nothing, ...	Nothing, ...	Nothing, ...	300	250	130
PLAT 5, . .	25 lbs. ammonium sulphate (=5 lbs. nitrogen).	50 lbs. ammonium sulphate (=10 lbs. nitrogen).	50 lbs. ammonium sulphate (=10 lbs. nitrogen), and 97 lbs. potash-magnesia sulphate (=25 lbs. potassium oxide), ...	360	280	635
PLAT 6, . .	Fallow, ...	Fallow, ...	Fallow, ...	–	–	–
PLAT 7, . .	50 lbs. dissolved bone-black (=8.5 lbs. available phosphoric acid).	100 lbs. dissolved bone-black (=17 lbs. available phosphoric acid).	100 lbs. dissolved bone-black (=17 lbs. available phosphoric acid), and 50 lbs. muriate of potash (=25 lbs. potassium oxide), ...	280	255	730
PLAT 8, . .	Nothing, ...	Nothing, ...	Nothing, ...	250	195	165
PLAT 9, . .	25 lbs. muriate of potash (=12 to 13 lbs. potassium oxide).	50 lbs. muriate of potash (=25 lbs. potassium oxide).	50 lbs. muriate of potash (=25 lbs. potassium oxide), ...	945	840	655
PLAT 10, . .	48½ lbs. of potash-magnesia sulphate (=to 12 to 13 lbs. potassium oxide).	97 lbs. potash-magnesia sulphate (=to 25 lbs. potassium oxide).	97 lbs. potash-magnesia sulphate (=25 lbs. potassium oxide), and 60 lbs. dried blood (=7 to 8 lbs. nitrogen), ...	845	895	940

Plat 0 was thrown out of the experiment.

FIELD A
1887.
CORN PLATS WITH DRAINAGE SYSTEM
SCALE 4 RODS TO 1 INCH
0. UNFERTILIZED.
1. 50 LBS NITRATE OF SODA & 50 LBS MURIATE OF POTASH
2. UNFERTILIZED
3. 60 LBS DRIED BLOOD & 100 LBS PIS. BONE BLACK.
4. UNFERTILIZED
5. 50 LBS SULPHATE OF AMMONIA & 97 LBS POTASH MAGNESIA SULPHATE
6. UNFERTILIZED FALLOW.
7. 100 LBS PIS. BONE BLACK & 50 LBS MURIATE OF POTASH
8. UNFERTILIZED.
9. 50 LBS MURIATE OF POTASH
10. 97 LBS POTASH MAGNESIA SULPHATE & 60 LBS DRIED BLOOD.

2. Influence of Fertilizers on the Quantity and the Quality of some Prominent Fodder Crops.

(Field B.)

The land selected for the experiment had been used for several years for the production of hay. At the beginning of the season of 1883 it had been ploughed and planted with corn, *without the addition of any fertilizer*. The soil consisted of a good, sandy loam, and was, in consequence of its previous treatment, in a *suitably impoverished condition* to respond to the application of fertilizers.

The entire field, consisting at that time of one and one-tenth acres, was sub-divided into plats, each one-tenth of an acre in size. Every alternate plat was fertilized at the rate of six hundred pounds of ground, rendered bones, and two hundred pounds of muriate of potash, per acre. The fertilizer was applied a few days before seeding, and slightly harrowed under.

1884. — The experiment in this year comprised four standard grasses; i. e., Orchard grass (*Dactylis glomerata*), Meadow Fescue (*Festuca pratense*), Timothy (*Phleum pratense*) and Redtop (*Agrostis vulgaris*), besides two Millets, Hungarian grass (*Panicum Germanicum*) and Pearl Millet (*Penicillaria spicata*), and one variety of corn, Clark.

Plats No. 11, 13, 15, 19 and 21 were fertilized; and Nos. 12, 14, 16, 18 and 20 received no manurial matter of any description. In the case of the grasses and millets, each plat was again sub-divided into two, and each half seeded down with one distinct kind of grass seed, as follows: —

Plat No. 11 (fertilized), . . .	Orchard Grass (north side). Meadow Fescue (south side).
Plat No. 12 (unfertilized), . .	Orchard Grass (north side). Meadow Fescue (south side).
Plat No. 13 (fertilized), . . .	Hungarian Grass (north side). Pearl Millet (south side).
Plat No. 14 (unfertilized), . .	Hungarian Grass (north side). Pearl Millet (south side).
Plat No. 15 (fertilized), . . .	Timothy (north side). Redtop (south side).

Plat No. 16 (unfertilized), . . { Timothy (north side). Redtop (south side).

Plats No. 17, 18, 19, 20 and 21 were planted with corn (Clark).

1885. — During the year 1885, Plats No. 17, 18, 19, 20 and 21 served again, as in previous years, for the cultivation of corn. The entire crop upon all plats was cut Sept. 4, 1885. The dry corn fodder secured from the fertilized plats averaged $5\frac{1}{6}$ tons per acre, and that from the unfertilized plats yielded $3\frac{1}{10}$ tons for the same area. The fertilized Plat No. 13 produced 1,870 pounds of dried millet, or 18,700 pounds ($9\frac{1}{3}$ tons) per acre; and the unfertilized Plat No. 14 (for three succeeding years without manure) produced 1,050 pounds of air-dried crops, or 10,500 pounds ($5\frac{1}{4}$ tons) for a corresponding area.

The Plats 11, 12, 15 and 16 (Field B), which had been seeded down broadcast during the month of September, 1884, with several varieties of grasses, for the purpose of studying their individual nutritive character at different successive stages of growth, soon became infested with all kinds of plants. As this circumstance could not otherwise than quite seriously interfere with our object, it was thought best to re-plough these plats, and *to seed down again each variety of grass, in drills.* The cultivation of grasses in drills, two feet apart, was adopted with much success, June 22, 1885. A frequent use of the cultivator, aided by the hoe and hand-weeding, has enabled us to secure, as far as practicable, a clean growth.

1886. — No material change was made in the general arrangement and mode of treatment of the plats in Field B, beyond the addition, on the west end of each plat, of an area forty-three feet in length, and a width corresponding to that of the existing plats. This addition makes the present length of these plats 175 feet; they are each 33 feet wide.

The same varieties of grasses and of corn (Clark) were cultivated. The latter was also planted, in place of two varieties of millets, cultivated during the preceding year, in Plats 13 and 14. The corn was planted, as in previous years, in drills three feet three inches apart; the seed was dropped, from six to eight in a place, at a distance of from

twelve to fourteen inches apart, May 17, 1886. Plats 13, 17, 19 and 21 were fertilized with ground bone and potash, as in preceding years; while Plats 14, 18 and 20 received no manurial matter of any description. The growth of the corn on fertilized and unfertilized plats presented throughout the season a similar appearance, as has been noticed and described on previous occasions, with the exception of the fertilized Plat 13 and the unfertilized Plat 14, which yielded a larger return than any other of the plats under a corresponding treatment. These two plats had been changed from the cultivation of corn, in 1883, to that of millet, in 1884 and 1885.

For further details regarding yield, etc., we have to refer to pages 71 and 72 of our fourth annual report.

The entire field was ploughed during fall, to prepare it for experiments with other crops in the succeeding year. The samples of the various grasses on trial had been collected at successive stages of growth, to ascertain their composition. The results of these analyses are contained in the following tabular statement.

ORCHARD GRASS (Hay).

	Collected June 7, 1886, while in Bloom.		Collected June 30, 1886, in Seed.	
	Fertilized.	Unfertilized.	Fertilized.	Unfertilized.
Moisture at 100° C.,	9.09	9.16	8.38	8.72
Dry Matter,	90.91	90.84	91.62	91.28
	100.00	100.00	100.00	100.00
Analysis of Dry Matter.				
Crude Ash,	7.90	8.67	6.17	5.46
" Cellulose,	34.12	34.15	35.48	35.79
" Fat,	2.41	2.40	3.56	3.26
" Protein (Nitrogenous Matter),	8.94	11.24	7.57	8.15
Non-nitrogenous Extract Matter,	46.63	43.50	47.22	47.34
	100.00	100.00	100.00	100.00

REDTOP (Hay).

	Collected July 5, 1886, while in Bloom.		Collected July 22, 1886, in Seed.	
	Fertilized.	Unfertilized.	Fertilized.	Unfertilized.
Moisture at 100° C.,	6.81	7.75	8 24	8.02
Dry Matter,	93.19	92 25	91 76	91.98
	100.00	100.00	100.00	100.00
Analysis of Dry Matter.				
Crude Ash,	5.69	5.17	4.84	4.17
" Cellulose,	34.11	32 95	33.49	31 12
" Fat,	1.56	1.64	1.50	1.69
" Protein (Nitrogenous Matter),	8.32	8.40	6.41	8.28
Non-nitrogenous Extract Matter,	50.32	51.84	53.76	54.74
	100.00	100 00	100.00	100.00

MEADOW FESCUE (Hay).

	Collected June 28, 1886, in Seed.	
	Fertilized.	Unfertilized.
Moisture at 100° C.,	7.40	8.03
Dry Matter,	92.60	91.97
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	7.17	8.18
" Cellulose,	34 46	34.61
" Fat,	2.17	1.78
" Protein (Nitrogenous Matter),	7.02	7.27
Non-nitrogenous Extract Matter,	49.18	48.16
	100.00	100.00

TIMOTHY (Herds' Grass).

	Collected June 28, 1886, while in Bloom.	
	Fertilized.	Unfertilized.
Moisture at 100° C.,	65.74	65.00
Dry Matter,	34.26	35.00
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	5.29	5.37
" Cellulose,	33.23	32.50
" Fat,	1.95	2.07
" Protein (Nitrogenous Matter),	8.20	8.83
Non-nitrogenous Extract Matter,	51 33	51.23
	100.00	100.00

Fertilizing Ingredients of Timothy.

	Fertilized.	Unfertilized.
Moisture at 100° C.,	7.80	7.24
Phosphoric acid (6 cents per pound),	0.36	0.56
Potassium oxide (4¼ cents per pound),	1.63	1.44
Nitrogen, (17 cents per pound),	1.21	1.31
Sodium oxide,	0.08	0.37
Calcium oxide,	0.44	0.99
Magnesium oxide,	0.12	0.09
Insoluble matter,	1.01	1.33
Valuation per 2,000 pounds.	$5 93	$6 35

Fertilizing Ingredients of Orchard Grass.

[I. Fertilized. Collected in bloom, June 7, 1886. II. Unfertilized. Collected in bloom, June 7, 1886. III. Fertilized. Collected in seed, June 30, 1886. IV. Unfertilized. Collected in seed, June 30, 1886.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	9.09	9.16	8.38	8.72
Phosphoric acid,	0.483	0.399	0.329	0.444
Potassium oxide,	2.339	2.114	1.758	1.303
Nitrogen,	1.300	1.640	1.109	1.190
Sodium oxide,	0.211	0.233	0.246	0.211
Calcium oxide,	0.401	0.457	0.496	0.470
Magnesium oxide,	0.255	0.236	0.192	0.505
Ferric oxide,	0.014	0.021	0.063	0.024
Insoluble matter,	1.867	1.976	2.280	2.116
Valuation per 2,000 pounds,	$6 99	$7 86	$5 66	$5 69

Fertilizing Ingredients of Redtop Hay.

[I. Fertilized. Collected in bloom, July 5, 1886. II. Unfertilized. Collected in bloom, July 5, 1886. III. Fertilized. Collected in seed, July 22, 1886. IV. Unfertilized. Collected in seed, July 22, 1886.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	6.81	7.75	8.24	8.02
Phosphoric acid,	0.377	0.391	0.352	0.326
Potassium oxide,	1.206	1.054	1.160	0.659
Nitrogen	1.240	1.248	0.940	1.219
Sodium oxide,	0.180	0.425	0.829	0.317
Calcium oxide,	0.614	0.645	0.451	0.575
Magnesium oxide,	0.125	0.149	0.149	0.111
Ferric oxide,	0.024	0.033	0.038	0.060
Insoluble matter,	1.716	1.683	1.710	1.836
Valuation per 2,000 pounds,	$5 53	$5 59	$4 61	$5 07

Fertilizing Ingredients of Meadow Fescue.

[I. Fertilized. Collected in seed, June 28, 1886. II. Unfertilized. Collected in seed, June 28, 1886.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	7.40	8.03
Phosphoric acid,	0.230	0.229
Potassium oxide,	1.815	2.183
Nitrogen,	1.04	1.07
Sodium oxide,	0.080	0.139
Calcium oxide,	0.540	0 466
Magnesium oxide,	0.140	0.136
Ferric oxide,	0.027	0.025
Insoluble matter,	1.403	1.961
Valuation per 2,000 pounds,	$5 36	$5 87

The higher percentage of *nitrogenous matter* in the crop from the *unfertilized* plats, over that from the *fertilized* plats, finds its explanation in the fact that, owing to the scanty supply of plant-food in the former, the plants matured at an earlier date. The advantages of fertilization are, therefore, not shown in the percentage of nitrogenous matter, but in an increased total yield of a healthy, vigorous growth.

1887. — The lands were ploughed and harrowed during the second week of May. The original lines of sub-division were retained. Plats 12, 14, 16, 18 and 20 remained unfertilized, as in previous years. Plats 11, 13, 15, 17, 19 and 21 were fertilized, as before, with a mixture of 600 pounds of fine-ground bones, and 200 pounds of muriate of potash, per acre. The fertilizer was applied broadcast, and slightly harrowed under before seeding. The different plats were planted May 18, and the seeds, in every case, laid in drills, from two feet to three feet three inches apart, as circumstances advised, — grasses and clovers, two feet, and corn and peas, three feet three inches, apart.

Plat No. 11 (fertilized),	Corn (Clark variety).
Plat No. 12 (unfertilized),	Corn (Clark variety).
Plat No. 13 (fertilized),	Italian Rye Grass (Lolium Italicum). English Rye Grass (Lolium pevenne).
Plat No. 14 (unfertilized),	Italian Rye Grass (Lolium). English Rye Grass (Lolium).
Plat No. 15 (fertilized),	5 varieties Southern Cow Pea.
Plat No. 16 (unfertilized),	5 varieties Southern Cow Pea.
Plat No. 17 (fertilized),	Meadow Fescue *(Festuca pratensis)*.
Plat No. 18 (unfertilized),	Alsyke Clover. Medium Red Clover.
Plat No. 19 (fertilized),	Alsyke Clover. Medium Red Clover.
Plat No. 20 (unfertilized),	Mammoth Red Clover. Alfalfa (Luzerne).
Plat No. 21 (fertilized),	Mammoth Red Clover. Alfalfa (Luzerne).

The results regarding the yield of the annual plants — corn and cow peas — are stated below; while the record of the comparative yield of the perennial plants — grasses and clovers — are reserved for another year. The majority of these plants show their respective values as fodder plants better in the second year, when seeded somewhat late in the spring. Our present communication is, for this reason, confined to some analyses of the first cut of Alfalfa, and Alsyke clover.

Plat 11 (fertilized) yielded 3,910 pounds of green fodder corn; Plat 12 (unfertilized) yielded 2,890 pounds of green fodder corn, — a difference of thirty per cent. in favor of the fertilized plat. The plant-food coming from the disintegration of the sod of the preceding grass crop has evidently favored an increased production upon the unfertilized plat.

Plats 15 and 16 were each planted May 18, with five different varieties of Southern peas, the seeds of which were secured of J. J. Wolfenden, provision dealer in Newberne, N. C.

1. Sugar Crowder.
2. Black (Pallack).
3. Whippoorwill Cow Pea.
4. Clay Cow Pea.
5. Crowder.

The entire lot grew slowly at first until the season turned warmer. The vines of No. 5 became diseased, and dried up prematurely. Nos. 2, 3 and 4 produced a voluminous

growth, from 28 to 30 inches high. None but No. 2 produced, to any extent, matured pods.

The entire yield on Plat 15 (fertilized) amounted to 2,400 pounds of green crop, containing from 18 to 19 per cent. of dry vegetable matter.

Plat 16 (unfertilized) produced 1,300 pounds of green fodder, — a difference of 54 per cent. in favor of the fertilized plat. An analysis of No. 4, Clay variety of Southern cow pea (*Dolichos*) will be found in a later chapter, on new fodder crops. The crop was cut for fodder, Aug. 29 to Sept. 3.

ALFALFA (Luzerne; Hay).

[Collected from Experiment Station Plats, Aug. 16, 1887, while in bloom. First Cut.]

	Fertilized.	Unfertilized.
Moisture at 100° C.,	8.33	8.41
Dry Matter,	91.67	91.59
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	7.18	7.83
" Cellulose,	28.54	27.86
" Fat,	1.54	2.04
" Protein (Nitrogenous Matter),	11.12	12.96
Non-nitrogenous Extract Matter,	51.62	49.31
	100.00	100.00

ALSYKE CLOVER (Hay; Trifolium Hybridum).

[Collected from the Experiment Station Plats, Aug. 16, 1887, while in bloom.]

	Fertilized.	Unfertilized.
Moisture at 100° C.,	8.64	8.30
Dry Matter,	91.36	91.70
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	10.92	13.35
" Cellulose,	26.28	21.44
" Fat,	2.89	3.26
" Protein (Nitrogenous Matter),	14.97	17.32
Non-nitrogenous Extract Matter,	44.94	44.63
	100.00	100.00

Fertilizing Ingredients of (1) Alfalfa, (2) Alsyke Clover.

[I. Alfalfa. Fertilized. II. Alfalfa. Unfertilized. III. Alsyke Clover. Fertilized. IV. Alsyke Clover. Unfertilized.

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	8.33	8.41	8.64	8.30
Phosphoric acid,	0.444	0.458	1.016	0.584
Potassium oxide,	2.043	0.872	2.740	1.605
Nitrogen,	1.630	1.900	2.190	2.540
Sodium oxide,	0.668	1.354	0.236	0.570
Calcium oxide,	1.486	2.558	1.644	1.836
Magnesium oxide,	0.249	0.582	0.735	0.610
Ferric oxide,	0.105	0.085	0.417	0.246
Insoluble matter,	0.716	0.687	3.226	3.241
Valuation per 2,000 pounds,	$7 81	$7 65	$11 00	$10 70

The higher per cent. of nitrogenous matter in the crop from the *unfertilized* plats, over that from the *fertilized* plats, finds its explanation in the fact that, owing to the scanty supply of plant-food in the former, the plants matured at an earlier date. The advantages of fertilization are, therefore, not shown in the percentage of nitrogenous matter, but in an increase of total yield of a healthy, vigorous growth.

FIELD B.

1887.

SCALE 4 RODS TO 1 INCH

S.

21.	MAMMOTH RED CLOVER.	
	ALFALFA	FERTILIZED
20.	MAMMOTH RED CLOVER.	
	ALFALFA.	UNFERTILIZED
19.	ALSIKE CLOVER.	
	MEDIUM RED CLOVER	FERTILIZED
18.	ALSIKE CLOVER.	
	MEDIUM RED CLOVER.	UNFERTILIZED
17.	MEADOW FESCUE	FERTILIZED
16.	COW PEAS { 1 SUGAR CROWPEA. 2 BLACK 3 WHIPPORWILL 4 CLAY 5 THOMAS CROWDER	UNFERTILIZED
15.	COW PEAS { 1 SUGAR CROWPEA. 2 BLACK. 3 WHIPPORWILL 4 CLAY 5 THOMAS CROWDER	FERTILIZED.
14	ITALIAN RYE GRASS	
	RYE GRASS.	UNFERTILIZED
13.	ITALIAN RYE GRASS.	
	RYE GRASS.	FERTILIZED
12	CLARK CORN.	UNFERTILIZED
11.	CLARK CORN	FERTILIZED

N.

3. Experiments with Wheat.

(Fourteen Varieties.)

[Field C]

Fourteen varieties of winter wheat were sown on the south half of Field C, in drills, eighty feet in length and three feet three inches apart, during the first week of October, 1886. The rows, eight in number, ran north and south.

The soil consisted of a good loam; the fertilizers used were 600 pounds of ground bone, and 200 pounds of muriate of potash, per acre. Eight rows of the following fourteen varieties were sown: (1) Genoese, (2) Egyptian, (3) Indian, (4) White Crimean, (5) Fulcaster, (6) Genoese, (7) German Emperor, (8) Raub's Black Prolific, (9) McGehee (white), (10) Diehl — Mediterranean, (11) Four-rowed Sheriff, (12) Martin's Amber, (13) Extra Early Oakley, (14) Amber (Mass.). The seed for the first thirteen varieties named was sent on by the U. S. Department of Agriculture; that of the fourteenth was obtained from Joseph Breck & Sons, Boston, Mass., for the purpose of comparing one of our reputed home varieties with those sent on.

The first four varieties (Genoese, Egyptian, Indian and White Crimean) were on the eastern portion of the field, which was low and moist; they were entirely winter-killed, and serradella was planted in their places. Numbers 6 and 11 (Genoese and Four-rowed Sheriff) were also largely winter-killed, — so much so, that at time of harvest they were left as worthless on the field. The Extra Early Oakley (13) was the first variety to head, — the 3d of June. On June 7 it was followed by number 14, — our native Amber Wheat. June 13, all save number 11 (Four-rowed Sheriff) had headed. July 19, each variety was stooked by itself, with the exception of Genoese (6) and Four-rowed Sheriff (11), which were not far enough advanced, and of poor growth. July 29, they were taken to the barn and threshed. Every variety was more or less affected by the rust.

The following table shows growth, height, color and yield of the eight rows of the different varieties that matured: —

VARIETY.	Growth.	Height in Inches.	Color.	Bearded or Unbearded.	YIELD OF THE 8 ROWS.			Remarks.
					Weight of Straw.	Weight of Grain.	Weight of Chaff.	
5. Fulcaster,	Compact, strong,	48	Light,	Bearded,	130	67	21	Evidently a mixture of two different varieties.
7. German Emperor,	Compact, strong,	48	Light,	Bearded, Unbearded,	115	54	15	
8. Raub's Black Prolific,	Not very compact,	36	Dark,	Bearded,	75	40	20	
9. McGehee (White),	Not very compact,	39	Dark,	Unbearded,	60	36	9	
10. Diehl — Mediterranean,	Compact,	39	Dark,	Bearded,	80	52	18	
12. Martin's Amber,	Compact,	42	Light,	Unbearded,	90	38	10	
13. Extra Early Oakley,	Not very compact,	33	Light,	Bearded,	60	36	9	
14. Amber (Mass.),	Compact,	39	Dark,	Bearded,	160	74	24	

None of the imported varieties exceeded our home Amber wheat in any essential point.

Vetch (Vicia sativa) *and Oats.* — An area of a small fraction over one-fifth of an acre was sown broadcast, May 16, with vetch and oat seed, — one part of vetch to three parts of oats.

The soil was prepared for the crop in the same way as in the case of wheat.

On the 25th of May the young plants appeared above ground. The first cutting was made July 8, the crop then standing three and one-half feet high, and the vetch being in bloom; the cutting was stopped July 26. Two hundred pounds per day were cut, on the average, to serve in our second feeding experiment with milch cows. It was relished by them much more than during the previous year, when the vetch was sown alone.

The yield of the area was fully two tons of green crop, which would give an estimated yield of 10.89 tons of green fodder per acre.

Composition of Green Vetch and Oats.

	July 7.	July 20.	July 26.	Average.
Moisture at 100° C., . .	86.11	73.66	73.05	76.61
Dry Matter, ...	13.89	23.34	23.95	23.39
.	100.00	100.00	100.00	100.00

The feeding ceased when the oats turned yellow.

Analysis of Green Vetch and Oats.

[Collected from Experiment Station Field, July 8, 1887.]

	Per cent.
Moisture at 100° C., ...	86.11
Dry Matter, ...	13.89
	100.00

Analysis of Dry Matter.

Crude Ash, ...	12.37
" Cellulose, ...	34.20
" Fat, ...	2.74
" Protein (Nitrogenous Matter), ...	10.59
Non-nitrogenous Extract Matter, ...	40.10
	100.00

The vetch has already received considerable attention in various sections of our country; reports, thus far, speak with much satisfaction of the results. The plant resembles, in many respects, the common garden pea; there are early and late varieties in cultivation. Its period of vegetation is from 18 to 22 weeks, and the time of seeding corresponds to that of the pea. The common vetch is a hardier plant than the latter, and grows well upon an inferior soil. Its reputation as a valuable green fodder, either single or when grown in common with rye, oats or barley, is well established.

An equal number of both plants gives a richer green fodder than the proportion we tried.

Serradella (Ornithopus sativus, Brot.). — The area occupied by this plant was 206 feet long by 80 feet wide, and belonged to a piece of land prepared in common with that used for the cultivation of the varieties of wheat.

The seed was sown in drills, three feet three inches apart, May 25. The plants began to bloom July 12. The cutting of the crop for green fodder commenced Sept. 2; from 200 to 300 pounds were used per day, as part of the feed for three cows. The supply lasted until Sept. 26. The yield on our field amounted to 7,300 pounds of green fodder, or 9½ tons per acre, with an average of from 18 to 20 per cent. of dry vegetable matter.

The serradella, like the vetch, is an annual leguminous plant, which found its way from Portugal into Central Europe some fifty years ago. It grows from one to one and one-half feet high, and prefers a moist, deep, sandy soil. Time of seeding and mode of cultivation correspond with that customary in the cultivation of peas. The growth of the plant is slow until the time of blooming, when it rapidly increases in size and nutritive constituents.

The close of the blooming period, at the end of August or beginning of September, is with us the best time for cutting the crop. Leading agriculturists speak very highly of this fodder plant.

Our results in the field and in our feeding experiments (see "Feeding Experiment with Milch Cows, II.," in this report) have been for several years very satisfactory. The cows relish the serradella highly.

Analysis of Green Serradella.

[Collected from the Experiment Station Fields, Sept. 20, 1887.]

	Per cent.
Moisture at 100° C.,	80.58
Dry Matter,	19.42
	100.00

Analysis of Dry Matter.

Crude Ash,	11.53
" Cellulose,	38.76
" Fat,	2.09
" Protein (Nitrogenous Matter),	12.01
Non-nitrogenous Extract Matter,	35.61
	100.00

Southern Cow Pea (Dolichos?); variety, Clay. — This valuable variety of Southern cow pea has been raised for several years past, with very satisfactory results, upon the grounds of the Experiment Station. Its exceptionally high value for green manuring and for renovating the soil, has been pointed out in previous annual reports. During the past summer season we have studied its comparative value as green fodder for milch cows. The results of these experiments are stated in this report under the head of "Feeding Experiments with Milch Cows, II." The cow pea is much liked by cows and horses, and its effect as an essential part of the daily diet for milch cows is very satisfactory, judging from our own results.

The fact that the seeds of the Clay or Whippoorwill varieties cannot be matured in our section of the country, cannot be considered a serious impediment to its more general use, for the seeds may be had in unlimited quantity at a very reasonable cost. J. J. Wolfenden, provision dealer in Newberne, N. C , among others, has offered his services for the purchase of genuine seeds, at reasonable terms.

The ground which served during the past summer season for the cultivation of Southern cow pea for feeding, adjoined that used for the raising of serradella and of wheat. The soil was prepared, as far as ploughing and fertilizing were concerned, in the same manner as that upon which wheat was raised. The seeds were planted May 25, in drills three feet three inches apart. The entire area occupied by the

crop, in this part of our experimental field, was 101.5 feet long and 80 feet wide; it yielded 3,765 pounds of green fodder, with an average of from 12 to 18 per cent. of dry vegetable matter. The rate of production per acre, calculated on the basis of our own observation, would be $9\frac{1}{2}$ tons of green fodder. A few weeks more of growth would have materially increased the yield. The course adopted in our feeding experiment obliged us to use the Southern cow pea, as the serradella was not yet far enough advanced in growth. Southern observers obtain from 20 to 25 tons of green crop per acre. The cutting of the pea vines for fodder began as early as Aug. 1, and lasted until Aug. 23. A new growth had started from the roots again Aug. 25; it proved, however, of but little value for feeding purposes, on account of the lateness of the season.

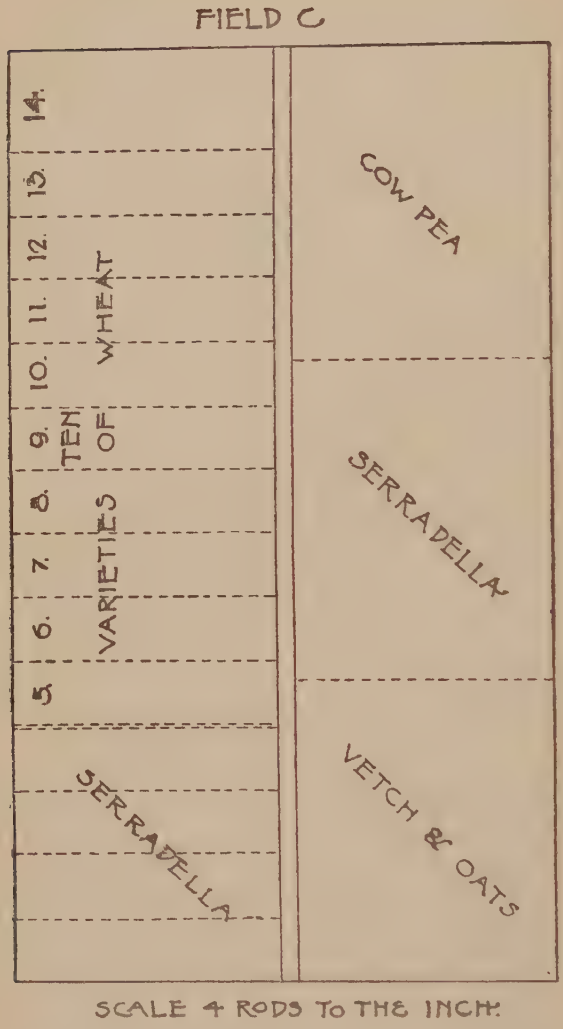
Analysis of Southern Cow Pea.

[Collected from Experiment Station Fields, Sept. 2, 1887.]

	Per cent.
Moisture at 100° C.,	78.81
Dry Matter,	21.19
	100.00

Analysis of Dry Matter.

Crude Ash,	5.97
" Cellulose,	23.02
" Fat,	1.81
" Protein,	8.28
Non-nitrogenous Extract Matter,	61.92
	100.00


FIELD C
14.
13.
12.
11.
10.
9.
8.
7.
6.
5.
TEN VARIETIES OF WHEAT
SERRADELLA
COW PEA
SERRADELLA
VETCH & OATS
SCALE 4 RODS TO THE INCH.

4. Experiments with Potatoes.

(Var.: Beauty of Hebron.)

[Field D.]

A. — *Experiments with High-grade German Potash Salts and Ground Bones, as Fertilizers.*

The experiments were originally instituted (1884) for the purpose of studying the effects of muriate of potash and sulphate of potash on the yield of potatoes, as far as quantity and quality are concerned.

Three plats, each one-fifth of an acre in size, were chosen for the experiment. The land had been for several years in grass, and contained quite a number of old apple-trees. The majority of the latter were removed, and the turf thoroughly broken up before manuring.

Plat 1 (west end) received 120 pounds of ground rendered bones, and 30 pounds of muriate of potash (equal to from 26 to 27 pounds of phosphoric acid, 4 to 4½ pounds of nitrogen, and 15 to 16 pounds of potassium oxide).

Plat 2 received no manure.

Plat 3 (east end) received 120 pounds of ground rendered bones, and 58 pounds of double sulphate of potash and magnesia (equal to from 26 to 27 pounds of phosphoric acid, 4 to 4½ pounds of nitrogen, 15 to 16 pounds of potassium oxide, and 5 to 6 pounds of magnesium oxide).

The fertilizers were applied broadcast, and harrowed under before planting. The potatoes were planted in rows three feet apart, and fourteen inches distant in the rows, during the first week in May, 1884. The crop was kept clean from weeds by a timely use of the cultivator.

As an additional feature of the experiment, one-half of each plant was planted with medium-sized whole potatoes, the other with half potatoes obtained from similar sized tubers.

The crop obtained from Plats 2 and 3 were seriously disfigured by scab, while that from Plat 1 had suffered less.

1885. — The arrangement of the field, the mode of manuring, and the variety of potatoes raised, were the same as

in the preceding season. The seed potatoes used had been carefully selected from our own crop, raised during the preceding season, on the same plats.

The young crop was hoed June 9. The difference in the plats was quite marked July 24: Plat No. 1, fertilized with muriate of potash, had the largest foliage and looked darker green than the remainder; No. 3, fertilized with sulphate of potash, looked next best. A *blight on the leaves*, which showed itself during the first week of August, prematurely terminated the experiment; the vines upon all plats died soon after. The crop was harvested Aug. 26. *The potatoes from all the plats suffered severely from scab.*

The exceptionally large proportion of small potatoes obtained, in particular, from Plats No. 2 and 3, as well as the low percentage of solids in the potatoes tested, proved the premature termination of a healthful condition of the entire crop. The normal growth of the tubers came apparently to a standstill soon after the first examination for solids had been made (July 24). The results seemed to indicate a connection between "blight" and "scab," and left scarcely any doubt about the circumstance, that either the one or the other, or both jointly, had contributed directly or indirectly towards the partial failure of the crop for the two succeeding seasons.

It was decided, in sight of these facts, to continue the experiments in 1886 upon the same field, with some modifications, to ascertain, if possible, whether the main influence regarding the results in our past observation had to be ascribed to atmospheric agencies, or to the condition of the soil and the fertilizer applied, or to the quality of the seed potato used.

1886. — The same field was used as in 1885. The land was well prepared by ploughing and harrowing, April 27, and subsequently fertilized, the same as in previous years. *The change regarding the character of the fertilizer applied, consisted in using nearly twice the amount of potash salts, muriate and sulphate of potash, for the same area, in case of Plats 1 and 3.* A second important change from our previous practice consisted in securing first quality seed potatoes, — in particular, *free* from scab The same variety —

Beauty of Hebron — was obtained for that purpose from Vermont; it was as fair an article as could be desired. The system of planting and cultivating was the same as in previous years. The potatoes were planted upon all plats May 5, 1886. All the vines were in full blossom July 6; they began to turn yellowish and dry up July 30. The crop on the entire field was dried up Aug. 8. This change seemed to appear most marked, and first, on the vines raised from whole potatoes. The crop was harvested Aug. 28.

Neither a liberal use of our own mixture of commercial manurial substances, rich in potash compounds, nor the selection of a fair quality of seed potatoes from another locality, had affected our results, as compared with those of the previous season; for the entire crop, with scarcely any exception, was badly disfigured by scab. The potatoes were unfit for family use, and had to be sold at a low price for stock-feeding.

For further details in regard to our observations in 1884, 1885 and 1886, see annual reports.

A due consideration of all the circumstances which accompanied our course of observation thus far, induced us to draw the following conclusions: —

1. Medium-sized *whole potatoes* give better results than half potatoes obtained from tubers of a corresponding size.

2. Disregarding the results of the first year, when previously existing resources of plant food in liberal quantities must have rendered the influences of an additional supply of manurial substances less marked, it appears that *sulphate of potash* produced *better* results in our case than muriate of potash.

3. The *premature dying out of the vines*, accompanied by *blight* or *scab*, or both, must be considered a *controlling cause* of the *exceptionally large proportion of small potatoes.*

4. Some peculiar condition of the soil upon the lands used for this experiment is to be considered the real seat of our trouble.

To test the correctness of conclusion 4 still further, the experiment has been continued for another year.

1887. — The same plats as in previous years were utilized for the experiment. The subdivision remained unchanged. The fertilizers applied were the same as in 1886.

The lands were ploughed and harrowed during the first week of May, and the potatoes planted in all the plats May 11. First quality potatoes, "Beauty of Hebron," raised in Vermont, were used as seed. The growth looked well upon all the plats until July 28, when the vines on Plats 2 and 3 began to turn yellow. They commenced drying up Aug. 9, and by Aug. 12 were dry on all plats. An examination of the little potatoes, July 1, showed already, in every case, the marks of scab.

The *entire crop*, when harvested, *was so seriously affected by scab* that it proved worthless in the general market.

The months of July and August were exceptionally wet and warm in our part of the State, — a circumstance which has, most likely, aggravated our trouble. The potato crop this year has been extensively a failure, in our vicinity, wherever low lands have been used for its cultivation.

B. — *Observations with Scabby Potatoes.*

These experiments were inaugurated in 1886, for the purpose of inquiring into the circumstances which control the development and the propagation of the scab on potatoes.

1886. — The first year's work in this connection has been confined to the task of observing the behavior of scabby potatoes as *seed* potatoes, under some definite previous treatment. To prevent a possible propagation of scab in the new crop by infected seed potatoes, the following course was adopted: Thoroughly scabby potatoes, obtained from the previously described experimental plats, were treated with some substances known to be destructive to various forms of parasitic growth. This operation was carried out with the intention of destroying the propagating power of adherent germs of an objectionable character, before planting the seed.

The field for the observation was distinctly separate from other experimental plats for the cultivation of potatoes. It had been used for many years previous for the raising of grass, and had since been planted but once, — the preceding year (1885), with corn. The land was prepared by ploughing and harrowing in the same way as other potato fields.

It was fertilized broadcast, at the rate of 600 pounds of ground rendered bones and 290 pounds of potash magnesia sulphate.

The field was subdivided into five plats of equal size, eighty feet long and fifty feet wide, and the potatoes subsequently planted in rows, three feet three inches apart, with hills three feet from each other in the rows. Three feet of space was left between the plats unoccupied. The scabby seed potatoes selected for the trial were, as far as practicable, of a uniformly medium size. Each lot was immersed in the particular solution prepared for the different plats; after being kept there for twenty-four hours they were removed and directly planted.

Plat 1 was planted with *healthy* and *smooth potatoes*, without any previous treatment. This course was adopted to learn whether soil, fertilizer, or atmospheric agencies of the season would favor the appearance of the scab in the crop.

Plat 2. The scabby seed potatoes were allowed to remain for twenty-four hours in a saturated solution of muriate of potash before being planted.

Plat 3. A strong solution of hypochlorite of lime (bleaching lime) was applied in a similar way, for the preparation of the scabby seed, as in the case of Plat 2.

Plat 4. A saturated solution of carbolic acid in water, served, in this instance, for the treatment of the scabby potatoes.

The potatoes were planted in all plats on the same day, May 7. The vines did not appear evenly, at first; they were, however, equally vigorous upon all plats at the close of June.

The tops on all plats were pretty generally dried up Aug. 18. The potatoes were harvested on the entire field Aug. 30. The yield on all the plats was fair, and the quality of the potatoes, almost without exception, excellent; this seemed to be more striking in regard to those on Plats 2, 3 and 4, which had been, in the beginning of the season, somewhat behind in growth. Here and there could be seen a potato with a small mark of scab; a large proportion were perfectly smooth and without any sign of it.

The results were recorded as those of a first experiment.

The fact that a *scabby potato* may produce, under certain circumstances, a smooth and otherwise excellent potato, was confirmed. Good potatoes have been raised before from seed potatoes suffering from scab, without any previous treatment similar to ours. Without any intention of anticipating the results of future observations, or to point out with certainty the exact cause of our results, we expressed the opinion that a *difference in the condition of the soil in our old and new experimental potato plats* might have proved to be the principal cause of our trouble: for the former yielded, from healthy potatoes, most inferior scabby potatoes; whilst the latter produced, from scabby potatoes, a most superior, smooth potato, under otherwise almost identical conditions, as far as soil, mode of cultivation and kind of fertilizer were concerned, upon land in close proximity, during the same season.

1887. — The experiment has been repeated during the past season upon the same lands, with but a slight modification. The soil was ploughed and fertilized as in the preceding year. Ten plats, each fifty feet long, were planted with four rows of potatoes, three feet three inches apart, and with nineteen hills in the row. Medium-sized, whole scabby potatoes (Beauty of Hebron), selected from the crop raised upon our own fields during the previous year, and which is described in some preceding pages, under the heading "Potato Experiment," "A," served as seed potatoes. One-half the plats were planted with scabby potatoes, all from the same lot, after being immersed for eighteen hours in some solution prepared for that purpose; and the other half were planted without any previous treatment of the seed, — Plats 2, 6 and 10 with our scabby potatoes, Beauty of Hebron, and Plats 4 and 8 with healthy, smooth tubers, of the same variety.

Plat 1, ...	Scabby potatoes, soaked in a solution of potassium sulphide
Plat 2, ...	Scabby potatoes, without any particular treatment.
Plat 3, ...	Scabby potatoes, treated with a solution of hypochlorite of lime (bleaching lime).
Plat 4, ...	Smooth, healthy potatoes, without previous treatment.

Plat 5, ... Scabby potatoes, treated with a solution of potassium chloride (muriate of potash).
Plat 6, ... Scabby potatoes, without previous treatment.
Plat 7, ... Scabby potatoes, treated with a solution of carbolic acid.
Plat 8, ... Smooth, healthy potatoes, not treated.
Plat 9, ... Scabby potatoes, treated with copper sulphate (blue copperas).
Plat 10, ... Scabby potatoes, not treated.

The young plants made their appearance on all the plats, except No. 9, June 1; those on No. 9 appeared eight or ten days later. The entire crop looked uniformly well. The vines dried up on all plats at about the same time. The crop was harvested with the following results: —

BEAUTY OF HEBRON.

PLAT.	Date of Planting.	Condition of Seed.	Solutions Used.	Results. (Sept. 12, 1887.)
No. 1,	May 12 to 14, 1887.	Scabby.	Potassium sulphide.	Good; not scabby.
2,		Scabby.	None.	Good; not scabby.
3,		Scabby.	Hypochlorite of lime (bleaching lime).	Especially good.
4,		Good.	None.	Somewhat scabby.
5,		Scabby.	Potassium chloride (muriate of potash).	Especially good.
6,		Scabby.	None.	Good; not scabby.
7,		Scabby.	Carbolic acid.	Especially good.
8,		Good.	None.	Especially good.
9,		Scabby.	Copper sulphide (blue copperas).	Only 7 hills left. More or less scabby.
10,		Scabby.	None.	Somewhat scabby.

A careful consideration of these results seems to show that a certain condition of the soil has been the leading cause for the origin and propagation of the scab; for scabby seed potatoes have produced healthy, smooth tubers, both with and without any special previous treatment, — see Plats 1, 2, 7 and 8. On the other hand, it is not without interest to notice that Plats 1, 3 and 7 have furnished us with some of the best potatoes we have raised during the past season.

The investigation will be continued, with some modifications, another year.

P. S. — One of the best results with the cultivation of various kinds of potatoes during the past season was noticed with some seed potatoes sent on by the United States Department of Agriculture, called "Polaris," and stated as being imported directly from Ireland.

Roots. — The seeds used in this trial were sent on by the United States Department of Agriculture, with the exception of No. 7, Saxony sugar beet, which was taken from our own collection of seeds. The supply of seeds was small.

The land consisted of a good loam in a fair condition of fertilization. It had been manured for several years past, annually, with a mixture consisting of 600 pounds of fine-ground bone, and 200 pounds of muriate of potash, per acre. The seeds, ten varieties in all, were sown May 25. Each variety occupied two rows across the field, of equal length (80 feet).

No. 1, ...	Beet, Mangel Wurzel, "Giant Long Red."
2, ...	Beet, Mangel Wurzel, "Yellow Ovoid."
3, ...	Beet, "Eclipse."
4, ...	Beet, "Red Globe."
5, ...	Beet, "Egyptian Turnip."
6, ...	Beet, "Long Smooth Red."
7, ...	Beet, Sugar Beet, "Saxony."
8, ...	Turnip, Ruta Baga, "White Sweet German."
9, ...	Turnip, "Early Yellow" or "Golden Stone."
10, ...	Turnip, Ruta Baga, "Skirving's Purple Top."

The rows were three feet three inches apart. The young plants were, in every case, thinned out or transplanted, as circumstances advised, to about eight inches distant from each other in the rows.

The transplanting and thinning out took place between July 5 and 11; the weather during this time was favorable for transplanting. The seeds of Nos. 6 and 9 did not prove as good as the others; the young plants of Nos. 5 and 9, in particular, did not do as well after transplanting as the remainder.

The crop was harvested partly Oct. 31 and partly Nov. 2. The first lot of roots, Nos. 1, 2, 3, 4 and 5, after being removed from the ground, was topped at once, and three

of each kind were taken to the laboratory for a chemical examination; three of an approximately corresponding size were photographed.

The second lot, Nos. 6, 7, 8, 9 and 10, was treated in a similar manner. The three sample roots selected in each case, represent, as far as practicable, the smallest, medium and largest of each variety raised.

The photographs were taken with all the roots at an equal distance from the camera.

STATEMENT OF RESULTS.

NAME OF VARIETY.	Number of Rows.	Number of Roots.	Weight of Roots.	Weight of three Samples Photographed.
			lbs.	lbs.
1. Mangel Wurzel, "Giant Long Red,"	2	150	365	11.75
2. Mangel Wurzel, "Yellow Ovoid,"	2	177	350	9.75
3. Beet, "Eclipse,"	2	163	285	4.
4. Beet, "Red Globe,"	2	173	335	7.5
5. Beet, "Egyptian Turnip,"	2	146	170	8.75
6. Beet, "Long Smooth Red,"	2	145	185	5.
7. Sugar Beet, "Saxony,"	3	216	470	8.75
8. Ruta Baga, "White Sweet German,"	2	176	445	4.
9. Turnip, "Early Yellow" or "Golden Stone,"	2	43	50	5.5
10. Ruta Baga, "Skirving's Purple Top,"	2	140	295	12.75

The analyses of the different varieties of roots will be reported as soon as finished.

MISCELLANEOUS FIELD EXPERIMENTS WITH FARM AND GARDEN CROPS.

The field notes under the above heading are made for no other purpose than to enter on record a series of experiments, for various reasons, not yet fit for a general report. In some instances the supply of seeds was too small to entitle us to draw any particular conclusion; in others, the selections of seeds were made merely for the purpose of preparing the lands for a future special field experiment.

The small supply of seeds was furnished, in the majority of cases, by the U. S. Department of Agriculture.

The work carried on in this connection has had, for obvious reasons, no other aim than to study the adaptation of some new field crop to our climate, or to compare some new variety of a prominent garden crop with those frequently raised in our section of the State. The field set aside for these experiments was in a good state of cultivation. Barnyard manure, supplemented by commercial phosphates and potash compounds, had been used in the past as manure; no alteration was made in this respect during the past season.

The list of seeds sown embraces, aside from those already mentioned in previous pages, one variety of mustard, "Southern Giant Curled;" three of pepper, "Cayenne," "Sweet Mountain," and "Golden Dawn;" two of tomato, "Paragon" and "Improved Mayflower;" one of cabbage, "Early Summer;" two of cauliflower, "Early Snow Ball" and "Giant Cauliflower," "Pyrethrum roseum"; and one variety of potato, "Polaris," in the form of seeds and seed potatoes (two tubers).

The seeds were, in every instance, sown in a hot-bed and subsequently transplanted in the field. All matured well, with the exception of *Pyrethrum roseum*, which is a perennial plant.

Aside from these plants, there have also been cultivated, on a small scale, Asiatic Rhubarb, Sago Bean (*Sago hispida*), wild potato from Colorado, and several reputed new varieties of potatoes, to secure material for future experiments.

The recently ploughed old grass lands, on the east side of the highway, were planted with potatoes, corn and horse beans, squashes, several varieties of oats, and barley. The lower portion, from five to six acres, has been laid down during the fall into a permanent meadow; while the remainder of worn-out grass land in that locality — from six to eight acres — has been underdrained and ploughed at the close of the season.

The details of the past year's work upon this part of the land of the Station will be related hereafter, in connection with a description of a more matured system of cultivation.

No. 1. Beet, Mangel Wurzel, "Giant Long Red".

WM. GIBB & POTTER PRINTING CO. STATE PRINTS

No. 2 Beet, Mangel Wurzel, "Yellow Ovoid"

No. 3 Beet, "Eclipse"

No. 4 Beet, "Red Globe

WRIGHT & PUTTER PRINTING CO. STATE PRINTERS.

No. 5. Beet, "Egyptian Turnip"

No. 6. Beet. "Long Smooth Red".

No. 7. Saxony Sugar Beet.

WRIGHT & TYLER PRINTING CO. STATE PRINTERS.

No. 8 Turnip, Ruta Baga, "White Sweet German".

No. 9. Turnip. "Early Yellow" or "Golden Stone."

WRIGHT & POTTER PRINTING CO., STATE PRINTERS.

No. 10. Turnip. Ruta Baga, "Skirvings Purple Top".

SUGGESTIONS UPON PLANTING TREES AND SMALL FRUITS.

[By S. T. Maynard, Professor of Botany and Horticulture, Massachusetts Agricultural College.]

The most important points to be considered in successful planting of trees and small fruits are: —

1. Selection of trees and plants.
2. Preparation of the trees and plants.
3. Soil and its preparation.
4. Methods of planting.
5. After-care and cultivation.

Selection of Trees and Planting.

Successful planting depends very largely upon the condition of the trees or plants at the time of planting The best results are generally obtained, *other things being equal*, when the trees or plants are obtained from local nurseries, and planted with little or no exposure to the drying influence of the sun and air. The merits of the Massachusetts-grown trees, as compared with those grown in the extensive nurseries of distant States, are often discussed, and the latter condemned for New England planting. While, in many of the above-mentioned nurseries, owing to long experience, especial skill and a soil naturally suited to the best growth, very fine trees are grown, perhaps better than are generally grown in small local nurseries, yet the danger from injury in transporting, should they go a great distance, and the length of time from digging to transplanting, will make it generally safer to depend upon home-grown trees where they can be obtained.

Great care must be exercised in digging, and, if large quantities are to be dug at once, as soon as a few are dug the roots should be protected by mats or blankets, or have soil thrown over them until all are to be packed for transporting or taken to the field for planting. In packing for shipping, no material is so good to keep the roots moist and prevent their heating as clean sphagnum moss; for short distances, moist straw or hay may answer very well for this purpose.

Vigorous young plants are much better than those that have been a very long time in growing to suitable size. The average age for fruit trees and plants in the best condition for transplanting is about as follows: Apple, three years from bud; pear, 3 years from bud; peach, 1 year from bud; plum, 2 years from bud; cherry, 2 years from bud; quince, 3 years from cutting or root graft; grape, 1 year No. 1, or 2 years No. 2, from cuttings or layers; currant, 2 years from cuttings; gooseberries, 2 years from cuttings; raspberries and blackberries, 1 year from suckers or root cuttings; strawberries, only new runners of last season's growth should be used, the old plants having black roots, with the feeding surfaces so far from the crown that when they are dug nearly all of them are destroyed.

Preparation of Trees and Plants for Planting.

It is impossible to remove a tree from the nursery to the orchard without injuring some of the larger roots, while nearly all the rootlets and all the root hairs will be destroyed by only a slight exposure to the air. As there are no feeding roots on the newly transplanted trees until new ones are formed, if none of the buds or shoots are removed, the supply of moisture being insufficient, all make a very feeble growth, or fail to develop at all, especially if a drought comes on early in the summer. To prevent this injury and ensure a vigorous starting of a few buds, the top should be cut back in proportion to the amount of injury to the roots, which will generally be from one-half to two-thirds of the entire top. In this pruning all shoots should be cut entirely away that are not needed for the formation of a perfect head, and the others cut back one-half or two-thirds of their length.

If the head is not formed high enough upon the trunk, it may often be carried higher by cutting off all lateral shoots, leaving the most central one for a leader, upon which will be formed the new head, several inches higher than the first. This may be still carried up by pinching the ends of the lowest laterals, to force the growth into the higher ones. Thus, in a single season, the head may be carried from one to two feet higher than it was when received from the nursery. All

injured roots should have the ends cut smooth with a sharp knife; and with small fruits, like the grape, currant and strawberry, it is often desirable to cut back some of the longer ones.

Soil and its Preparation.

Unless suitable soil is selected, very poor results will often be obtained. The apple thrives upon a greater variety of soils than any other fruit, but that best suited to its growth is a rich, moist, well-drained loam. The pear, plum and quince require a heavier soil, but it should be free from standing water. The cherry delights in a light, sandy loam. The peach can only be successfully grown in New England upon high and well-drained land. Upon the tops of our high hills the trees are hardier, live longer and bear more fruit, although, even here, they are not safe from injury, and annual crops cannot be expected until some method of protection has been discovered that can be easily and cheaply applied. Grape vines give the best fruit in quality when planted upon high, gravelly soil; but, to insure a vigorous growth of vine to enable a large crop of fruit to mature, some nitrogenous manure must be used, but only early in the season, as a late application would induce a late growth of wood, that is very liable to injury by severe cold.

The raspberry and blackberry mature their wood much better upon light land than upon heavy, moist soil, but, like the grape, require an addition of nitrogenous manure to secure a growth of canes sufficient to mature a large crop of fruit. Spreading mulch upon the surface, or constant cultivation, will generally prevent the escape of moisture at the time of the ripening of the fruit, when it is most needed.

The currant and gooseberry require a moist, heavy soil for the best results, but are liable to be thrown out by frosts if the soil is not well underdrained.

The best soil for the strawberry is a moist, sandy loam. Upon light, sandy soils there is a tendency to a large number of berries, but, there not being moisture enough in the soil, very few will mature.

Before planting it is necessary that the soil be made rich enough to ensure a good growth, if it is not already in that

condition. For small fruits it is generally best to apply the manure or fertilizers broadcast and harrow in, as it may also be done for the large fruits, if the land is to be cultivated with some other crop for a few years.

If the trees are to be planted in land not cultivated for other crops, the manure or fertilizer would be more economically applied only about the trees, increasing the area covered as they increase in size. Unfermented manure should never be placed in contact with the roots of any tree or plant, but if decomposed and well mixed with the soil, no injury will result from the use of a limited quantity. The best way to use coarse manure is to apply it to the surface about the trees slightly covered with soil. The quantity to be used must be varied with the condition of the soil, but should be used sparingly upon the peach until they begin bearing.

Perhaps the best material to use, where the soil is not sufficiently rich for the production of fruit, is fine-ground bone and potash, four parts of the former to one part of muriate of potash. This, at the rate of one pound to a tree, mixed in the fine soil used around the roots, and one pound applied near the surface, will insure a good growth, unless the soil is unusually poor. The holes should be dug a little larger than the roots will extend, and loosened a little deeper than they are to be planted. For convenience and beauty, trees should be set at regular distances.

Methods of Planting.

Generally the best time for planting is in the early spring, although it may be successfully done in the fall, when the leaves drop early and the shoots mature by Nov. 1.

In the spring, trees should not be planted until the ground will work up fine, and not compact when pressed about the roots. If the soil is light, the roots should be planted a little deeper than they grew in the nursery, but if moist, the same depth as they stood in the nursery is sufficient. Grape vines should be planted with the crown, or collar, within a few inches of the surface, and the roots extending six to ten inches deep, according to the soil. Raspberry, blackberry and strawberry plants should be planted as early in

the spring as the land will work. Black-cap raspberries must be planted with the large central bud near the surface, as deep covering often destroys it; the roots, however, must be put, obliquely, as deep as they will go. It is important that the soil be pressed *very finely* about the roots before all is filled in, and that upon the surface be left light.

It often happens that trees are received from the nursery in a dry, shrivelled condition, which, if planted in that state, would certainly fail to grow. They may be improved, and sometimes saved, by burying top and root in moist soil for a few days or a week; then, by severe pruning at planting, they will be much more certain to grow.

After Care.

It often happens that trees received in good condition, and very carefully planted, fail to grow from want of after care. This, for the first season, consists in seeing that a sufficient supply of moisture is present about the roots.

In time of drought, watering may be avoided by covering the ground, for several feet about the tree, with mulch, five or six inches deep, or by stirring the surface soil once or twice each week. Trees planted in turf are especially liable from the moisture being taken up by the surrounding grass roots. This can only be prevented by covering the ground with a mulch of any waste material, like corn stover, old hay, straw, shavings, sawdust, fine brush, cider pomace, meadow mud or peat.

The same result may be obtained by packing the loose stones often found about the trees. Mulching material of any kind should not be in contact with the trunk of the trees from Nov. 1 to May 1, unless they are protected by banking up, or by a tin or tar-paper band about them to protect from injury by mice.

VALUATION OF FERTILIZERS, AND FERTILIZER ANALYSES.

To assist the farmers, not yet familiar with the current mode of determining the commercial value of manurial substances offered for sale in our markets, some of the essential considerations, which serve as a basis for our valuation, are once more stated within a few subsequent pages.

The valuation of a fertilizer is based on the average trade value of fertilizing elements, specified by analysis. The money value of the higher grades of agricultural chemicals, and of the higher-priced compound fertilizers, depends, in the majority of cases, on the amount and the particular form of two or three essential articles of plant food; i. e., phosphoric acid, nitrogen and potash, which they contain. The valuation which usually accompanies the analyses of these goods shall inform the consumer, as far as practicable, regarding the cash retail price at which the several specified essential elements of plant food, in an efficient form, have been offered of late for sale, in our large markets.

The market value of low-priced materials used for manurial purposes, as salt, wood ashes, various kinds of lime, barnyard manure, factory refuse and waste materials of different descriptions, does not, quite frequently, stand in a close relation to their chemical composition. Their cost varies in different localities. Local facilities for cheap transportation, and more or less advantageous mechanical condition for speedy action, exert, as a rule, a decided influence on their selling price.

The wholesale market price of manurial substances is liable to serious fluctuations; for supply and demand exert here, as well as in other branches of commercial industry, a controlling influence on their temporary money value. As farmers have only in exceptional instances a desirable chance to inform themselves regarding conditions which control the market price, the assistance rendered in this connection by

agricultural chemists charged with the examination of commercial fertilizers, cannot otherwise but benefit, ultimately, both farmers and manufacturers.

The market reports of centres of trade in New England, New York and New Jersey, aside from consultations with leading manufacturers of fertilizers, furnish the necessary information regarding the current trade value of fertilizing ingredients. The subsequent statement of cash values in the retail trade is obtained by taking the average of the wholesale quotations in New York and Boston, during the six months preceding March 1, 1887, and increasing them by twenty per cent., to cover expense for sales, credits, etc.

These trade values, except those for phosphoric acid, soluble in ammonium-citrate, were agreed upon by the Experiment Stations of Massachusetts, Connecticut and New Jersey, for use in their several States for the present season.

Trade Values of Fertilizing Ingredients in Raw Materials and Chemicals.

	1887. Cents per Pound.
Nitrogen in nitrates,	16
Nitrogen in ammoniates,	17½
Organic nitrogen in dried and fine-ground fish,	17½
Organic nitrogen in Peruvian guano, blood, meat, azotin, ammonite, and castor pomace,	17½
Organic nitrogen in fine-ground bone and tankage,	16
Organic nitrogen in fine medium bone and tankage,	14
Organic nitrogen in medium bone and tankage,	12
Organic nitrogen in coarse medium bone and tankage,	10
Organic matter in coarse bone, horn shavings, hair and fish scraps,	8
Phosphoric acid, soluble in water,	8
Phosphoric acid, soluble in ammonia citrate,*	7½
Phosphoric acid, insoluble, in dry, fine-ground fish, in fish bone and tankage,	7
Phosphoric acid, insoluble, in fine, medium bone and tankage,	6
Phosphoric acid in medium bone and tankage,	5
Phosphoric acid in coarse medium bone and tankage,	4
Phosphoric acid in coarse bone and tankage,	3
Phosphoric acid in fine-ground rock phosphate,	2
Potash as sulphate, in compounds free from chlorine,	5½
Potash as kainite,	4¼
Potash as muriate,	4¼

* Dissolved from two grams of phosphate, unground, by 100 c.c. neutral solution of ammonium citrate, sp. gr. 1.09, in 30 minutes, at 65 deg. C., with agitation once in five minutes, commonly called "reverted" or "backgone" phosphoric acid.

The above trade values are the figures at which, on March 1, the respective ingredients could be bought at retail *for cash* per pound in our leading markets in the raw materials, which are the regular source of supply.

They also correspond to the average wholesale prices for the six months, ending March 1, plus 20 per cent. in case of goods for which we have wholesale quotations. The calculated values obtained by the use of the above figures will be found to agree fairly with the reasonable retail price in case of standard raw materials, such as:—

Sulphate of Ammonia,	Dried Ground Fish,
Nitrate of Soda,	Azotin,
Muriate of Potash,	Ammonite,
Sulphate of Potash,	Castor Pomace,
Dried Blood,	Bone,
Dried Ground Meat,	Plain Superphosphates.

Trade Values in Superphosphates, Special Manures and Mixed Fertilizers of High Grade.

The organic nitrogen in these classes of goods will be valued at the highest figures laid down in the "Trade Values of Fertilizing Ingredients in Raw Materials;" namely, 17.5 cents per pound, it being assumed that the organic nitrogen is derived from the best sources, namely, animal matter, as meat, blood, bones or other equally good forms, and not from leather, shoddy, hair, or any low-priced inferior form of vegetable matter, unless the contrary is ascertained.

Insoluble phosphoric acid will be valued at three cents, it being assumed, unless found otherwise, that it is from bone or similar sources, and not from rock phosphate. In this latter form the insoluble phosphoric acid is worth but two cents per pound. Potash is rated at 4½ cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate. If there is no more potash present than will combine with the chlorine, then the excess of potash will be counted as sulphate. To introduce large quantities of chlorides, common salt, etc., into a fertilizer, claiming sulphate of potash as a constituent, is a practice which, in our present state of information, will be considered of doubtful

merit. The use of the highest trade values is based on the opinion that these articles ought to contain the most efficient forms of fertilizing ingredients. In most cases the valuation of the ingredients in superphosphates and specials falls below the retail price of these goods. The difference between the two figures represents the manufacturers' charges for converting raw materials into manufactured articles. These charges are for grinding and mixing, bagging or barreling, storage and transportation, commission to agents and dealers, long credits, interest on investment, bad debts, and, finally, profits.

Local disadvantages for transportation exert, not infrequently, a serious influence on the cost of one and the same brand of fertilizers. Binding rules cannot be laid down regarding these points. Farmers must judge for themselves whether the difference between our valuation and the prices asked for is a fair one, considering local conditions of supply.

The prices stated in these bulletins, in connection with analyses of commercial fertilizers, refer to their cost per ton of 2,000 pounds on board of car or boat near the factory, or place of general distribution. To obtain the valuation of a fertilizer (*i. e.*, the money worth of its fertilizing constituents), we multiply the pounds per ton of nitrogen, etc., by the trade value per pound. We thus get the values per ton of the several ingredients, and, adding them together, we get the total valuation per ton.

The mechanical condition of any fertilizing material, simple or compound, deserves the most serious consideration of farmers, when articles of a similar chemical character are offered for their choice. The degree of pulverization controls, almost without exception, under similar conditions, the rate of solubility, and the more or less rapid diffusion of the different articles of plant food throughout the soil.

The state of moisture exerts a no less important influence on the pecuniary value, in case of one and the same kind of substance. Two samples of fish fertilizer, although equally pure, may differ from fifty to one hundred per cent. in commercial value, on account of mere difference in moisture.

Crude stock for the manufacture of fertilizers, and refuse

material of various descriptions, sent to the Station for examination, are valued with reference to the market prices of their principal constituents, taking into consideration, at the same time, their general fitness for speedy action.

A large percentage of commercial fertilizing material consists of refuse matter from various industries. The composition of these substances depends on the mode of manufacture carried on. The rapid progress in our manufacturing industry is liable to affect, at any time, more or less seriously, the composition of the refuse. A constant inquiry into the character of the agricultural chemicals, and of commercial manurial refuse substances offered for sale, cannot fail to secure confidence in their composition, and to diminish financial disappointment in consequence of their application. This work is carried on for the purpose of aiding the farming community in a clear and intelligent appreciation of the substances for manurial purposes.

Consumers of commercial manurial substances do well to buy, whenever practical, on guaranty of composition with reference to their essential constituents, and see to it that the bill of sale recognizes that part of the bargain. Any mistake or misunderstanding in the transaction may be readily adjusted, in that case, between the contending parties. The responsibility of the dealer ends with furnishing an article corresponding in its composition with the lowest-stated quantity of each specified essential constituent.

Sulphate of Ammonia.

[Sent on from Amherst, Mass. Two samples.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	1.63	.29
Nitrogen (17½ cents per pound),	21.68	20.97
Sulphuric acid,	59.64	59.20
Valuation per 2,000 pounds,	$75 88	$73 43

Nitrate of Soda.

[Sent on from Ashby, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	.96	1.35
Nitrogen (16 cents per pound),	14.66	16.14
Sulphuric acid,	Trace.	–
Chlorine,	Trace.	–
Valuation per 2,000 pounds,	$47 01	$51 65

Sulphate of Magnesia.

[Sent on from Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	29.01
Magnesium oxide,	15.87
Sulphuric acid,	30.35
Insoluble matter,	6.29

Ammonite.

[Sent on from Southampton, Mass.]

	Per cent.
Moisture at 100° C.,	6.17
Ash,	9.56
Nitrogen (17½ cents per pound),	12.20
Phosphoric acid (6 cents per pound),	3.40
Insoluble matter,	0.22
Valuation per 2,000 pounds,	$47 50

The material was in a fine mechanical condition, and thus in a favorable form for speedy disintegration.

Saltpetre Waste.

[Sent on from South Acton, Mass.]

	Per cent.
Moisture at 100° C.,	2.71
Sodium oxide,	45.92
Potassium oxide (4¼ cents per pound),	6.11
Calcium oxide,	0.71
Sulphuric acid,	0.84
Nitrogen in nitric acid (16 cents per pound),	0.80
Chlorine,	56.00
Valuation per 2,000 pounds,	$7 75

The sample contained less nitric acid and more potash than previous samples.

Felt Factory Waste.

[Sent on from Lowell, Mass.]

	Per cent.
Moisture at 100° C.,	39.24
Organic and volatile matter,	66.47
Ash,	33.53
Nitrogen (eight cents per pound),	5.26
Insoluble matter,	8.44
Valuation per 2,000 pounds,	$8 42

The principal part of the ash consisted of carbonate of lime. The material ought to be composted before being incorporated into the soil. For use in stables as an absorbent it deserves commendation.

Cotton-seed Meal.

[I. Sent on from Boston, Mass. II. Sent on from Ashby, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	10.200	7.71
Ash,	5.480	7.29
Phosphoric acid (6 cents per pound),	2.278	2.01
Magnesium oxide,	.478	1.13
Potassium oxide (4¼ cents per pound),	1.620	2.09
Sodium oxide,	.170	–
Ferric oxide,	.019	–
Calcium oxide,	.403	0.27
Nitrogen (17 cents per pound),	4.193	4.02
Insoluble matter,	.240	0.06
Valuation per 2,000 pounds,	$18 37	$17 86

Sea-weed Ashes.

[Sent on from Duxbury, Mass.]

	Per cent.
Moisture at 100° C.,	1.47
Calcium oxide,	6.06
Magnesium oxide,	4.37
Potassium oxide,	0.92
Sodium oxide,	8.72
Phosphoric acid,	0.30
Sulphuric acid,	2.98
Chlorine,	6.60
Sulphur,	0.14
Insoluble matter (before calcination),	63.65
Insoluble matter (after calcination),	56.28

The analysis of the above ash showed it to contain .14 per cent. of magnesium chloride.

Mussel and Mud.

[Sent on from Eastham, Mass.]

	Per cent.
Moisture at 100° C.,	2.24
Phosphoric acid (5 cents per pound),	0.35
Calcium oxide,	23.39
Iron and alumina,	8.26
Nitrogen (15 cents per pound),	0.72
Insoluble matter,	37.60
Valuation per 2,000 lbs.,	$2 50

Sea-weed.

[Sent on from Eastham, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	12.05	14.96
Ferric oxide,	0.25	0.09
Calcium oxide,	2.73	3.86
Phosphoric acid,	0.44	0.17
Magnesium oxide,	1.48	1.30
Sodium oxide,	11.75	8.40
Potassium oxide,	3.81	0.36
Chlorine,	6.40	5.28
Nitrogen,	1.66	1.28
Insoluble matter,	7.73	0.78

Muck.

[Sent on from Peabody, Mass.]

	Per cent.
Moisture at 100° C.,	89.89
Dry matter,	10.11
Ash in fresh muck,	3.05
Nitrogen in fresh muck,	.26

The ash contained a considerable portion of lime and magnesia compounds. The material is a fair specimen of its kind.

German Peat.

[Sent on from Millbury, Mass.]

	Per cent.
Moisture at 100° C.,	11.29
Nitrogen in organic matter (8 cents per pound),	1.23
Ash constituents,	1.23
Insoluble matter (in ash),	0.38
Valuation per 2,000 pounds,	$1 97

The material was well dried, and evidently designed to serve as an absorbent in some branch of manufacture.

Muriate of Potash.

[Sent on from Ashby, Mass. Four samples.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	0.15	1.16	0.75	0.57
Potassium oxide (4¼ cents per pound),	51.87	53.33	52.11	52.11
Sodium oxide,	–	–	–	10.13
Chlorine,	–	–	–	54.00
Valuation per 2,000 pounds,	$44 09	$45 33	$44 30	$44 30

Muriate of Potash.

[I. Sent on from Fitchburg, Mass. II. Sent on from North Hadley, Mass. III. Sent on from Amherst, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	0.15	1.05	1.86
Potassium oxide (4¼ cents per pound),	51.87	48.60	49.98
Sodium oxide,	–	5.70	–
Chlorine,	–	43.20	–
Valuation per 2,000 pounds,	$44 09	$41 31	$42 48

Sulphate of Potash and Magnesia.

[I. Sent on from Amherst, Mass. II. Sent on from Ashby, Mass. III. Sent on from Ashby, Mass]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	3.85	7.73	0.34
Magnesium oxide,	13.66	12.90	–
Potassium oxide (5½ cents per pound),	22.63	22.70	51.28
Sodium oxide,	6 34	4.22	–
Sulphuric acid,	47.28	45.61	46.41
Chlorine,	2.64	1.46	–
Insoluble matter,	0.80	0.46	0.93
Valuation per 2,000 pounds,	$24 89	$24 97	$56 41

Wood Ashes.

[I. and II. Sent on from Sunderland, Mass. III. Sent on from Northampton, Mass. IV. Sent on from Boston, Mass. V. Sent on from Amesbury, Mass.]

	Per Cent.				
	I.	II.	III.	IV.	V.
Moisture at 100° C.,	11.39	10.97	9.70	17.38	7.47
Phosphoric acid,	1.71	1.19	0.89	1.17	1.86
Magnesium oxide,	3.32	3.20	3.64	3.77	3.98
Calcium oxide,	37.25	36.46	37.23	31.50	39.05
Potassium oxide,	6.14	6.28	7.55	6.24	4.69
Insoluble matter (before calcination),	10.83	17.45	23.80	18.05	15.68
Insoluble matter (after calcination),	7.71	12.01	12.62	13.49	13.98

These samples are of good quality, with the exception of No. V. Unleached wood ash sells in our vicinity at from 24 to 25 cents per bushel of from 42 to 44 pounds.

Wood Ashes.

[I. Sent on from New York City, N. Y. II Sent on from North Hatfield, Mass. III. Sent on from Methuen, Mass. IV. Sent on from Eastham, Mass.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	4.73	14.19	17.33	13.59
Phosphoric acid,	–	0.81	–	1.46
Calcium oxide,	–	36.86	–	35.90
Magnesium oxide,	–	2.64	–	3.16
Potassium oxide,	3.40	7.23	7.22	5.74
Insoluble matter (before calcination),	22.49	6.48	7.05	10.64
Insoluble matter (after calcination),	15.42	5.81	–	7.55

Wood Ashes.

[Sent on from South Deerfield. Four samples.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	14.09	13.31	14.71	12.37
Phosphoric acid,	1.38	1.38	1.17	.98
Magnesium oxide,	3.35	3.48	3.57	3.58
Calcium oxide,	36.90	37.74	36.32	36.26
Potassium oxide,	6.72	4.86	6.85	6.77
Insoluble matter (before calcination),	8.20	7.46	14.65	17.78
Insoluble matter (after calcination),	6.42	5.80	9.14	10.45

Canada Wood Ashes.

[I. Hard-wood ashes. Sent on from Stockbridge, Mass. II. Sent on from Granby, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	19.16	13.53
Phosphoric acid,	1.32	1.31
Calcium oxide,	34.80	36.63
Magnesium oxide,	3.04	3.12
Potassium oxide,	5.65	6.22
Insoluble matter (before calcination),	7.48	9.22
Insoluble matter (after calcination),	5.64	6.95

Wood Ashes.

[Sent on from Amherst, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	17.22	10.87	9.52
Calcium oxide,	34.28	36.28	54.48
Magnesium oxide,	3.96	3.94	4.35
Potassium oxide,	4.42	5.37	5.23
Phosphoric acid,	1.54	1.14	1.65
Insoluble matter (before calcination),	16.82	11.76	11.14
Insoluble matter (after calcination),	12.46	10.11	9.97

Lime-kiln Ashes.

[Sent on from South Deerfield, Mass.]

	Per cent.
Moisture at 100° C.,	18.90
Phosphoric acid,	.36
Calcium oxide,	44.89
Magnesium oxide,	1.26
Potassium oxide,	.99
Insoluble matter (before calcination),	7.19
Insoluble matter (after calcination),	2.58

Wood Ashes (Canada).

[I. and II. Sent on from Boston, Mass. III. Sent on from Sunderland, Mass. IV. Sent on from Concord, Mass.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	11.12	8.67	1.10	15.98
Phosphoric acid,	2.05	1.59	1.08	1.34
Magnesium oxide,	3.30	3.18	2.93	4.45
Calcium oxide,	39.15	39.75	50.09	30.49
Potassium oxide,	5.30	5.58	2.93	4.76
Insoluble matter (before calcination),	9.80	10.10	9.59	16.91
Insoluble matter (after calcination),	8.67	9.17	7.38	14.14

Nos. 1, 2 and 4 are unleached Canada ashes; the large amount of moisture and of insoluble matter in No. 4 explains its lower percentage of potash. Sample No. 3 is a partially leached ash.

Cotton-seed Hull Ashes.

[Sent on from North Hadley, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	7.40	8.08
Potassium oxide (5½ cents per pound),	28.55	26.62
Magnesium oxide,	16.14	17.15
Phosphoric acid (6 cents per pound),	8.97	11.50
Calcium oxide,	10.58	11.37
Insoluble matter,	11.71	5.38
Valuation per 2,000 pounds,	$42 17	$43 08

These samples contain an exceptionally high percentage of potassium oxide and of phosphoric acid.

Cotton-seed Hull Ashes.

[Sent on from North Hadley, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	12.34	22.30
Potassium oxide (5½ cents per pound),	22.08	31.72
Magnesium oxide,	10.78	4.67
Phosphoric acid (6 cents per pound),	10.32	2.89
Calcium oxide,	6.64	3.35
Insoluble matter (before calcination),	20.08	7.59
Insoluble matter (after calcination),	17.06	7.30
Valuation per 2,000 pounds,	$36 67	$38 36

Soap-grease Residue.

[Sent on from South Lincoln, Mass.]

	Per cent.
Moisture at 100° C.,	38.79
Total phosphoric acid (5 cents per pound),	11.04
Insoluble phosphoric acid,	8.93
Reverted phosphoric acid,	2.11
Potassium oxide (4¼ cents per pound),	0.14
Nitrogen (12 cents per pound),	2.21
Insoluble matter,	1.20
Valuation per 2,000 pounds,	$16 24

Soup from Horse-rendering Establishment.

[Sent on from Arlington, Mass.]

	Per cent.
Moisture at 100° C.,	92.14
Total phosphoric acid (6 cents per pound),	0.14
Nitrogen (15 cents per pound),	1.12
Valuation per 2,000 pounds,	$3 53

Fish.

[I. Dried Fish; sent on by Swanzey Farmers' Club, Swanzey, Mass. II. Fish and Potash; sent on from Medfield, Mass. III. Fish Bone and Potash; sent on from Concord, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	9.17	26.75	16.93
Total phosphoric acid,	7.92	5.44	4.19
Soluble phosphoric acid,	0.64	2.00	0.39
Reverted phosphoric acid,	4.36	2.57	2.00
Insoluble phosphoric acid,	2.92	1.08	1.82
Potassium oxide,	None.	2.95	1.24
Nitrogen,	8.73	3.90	1.66
Insoluble matter,	2.69	1.59	30.80
Valuation per 2,000 pounds,	$39 87	$23 87	$11 54

Ground Bones.

[Sent on from Westford, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	3.94	9.74
Total phosphoric acid,	27.73	12.85
Soluble and reverted phosphoric acid (7½ cents per pound),	6.10	4.72
Insoluble phosphoric acid (5 cents per pound),	21.63	8.13
Nitrogen (15 cents per pound),	1.83	2.93
Insoluble matter,	0.10	2.61
Valuation per 2,000 pounds,	$36 27	$23 90

The mechanical condition of both samples was much the same; the valuation above given has been for this reason the same. The desirability of having ground bones sold only by a guaranteed composition finds an additional strong illustration in this case.

Ground Bone.

[Sent on from Concord, Mass.]

	Per cent.
Moisture at 100° C.,	3.05
Total phosphoric acid,	17.72
Reverted phosphoric acid (7½ cents per pound),	5.55
Insoluble phosphoric acid (4 cents per pound),	12.17
Nitrogen (15 cents per pound),	5.15
Insoluble matter,	1.19
Valuation per 2,000 pounds,	$33 52

Steamed Bone and Meat.

[Sent on from Fitchburg, Mass.]

	Per cent.
Moisture at 100° C.,	4.71
Total phosphoric acid (5 cents per pound),	20.28
Soluble phosphoric acid,	0.56
Reverted phosphoric acid,	4.54
Insoluble phosphoric acid,	14.18
Nitrogen (15 cents per pound),	5.37
Insoluble matter,	1.19
Valuation per 2,000 pounds,	$35 25

Ground Rock Phosphate.

[Sent on from West Springfield, Mass.]

	Per cent.
Moisture at 100° C.,	0.10
Total phosphoric acid,	30.51
Soluble phosphoric acid,	None.
Reverted phosphoric acid,	0.19
Insoluble phosphoric acid (2 cents per pound),	30.31
Magnesium oxide,	3.03
Calcium oxide,	41.87
Ferric and aluminum oxides,	4.26
Insoluble siliceous matter,	13.74

The material is of but little value for manurial purposes, without a previous treatment with sulphuric acid, to render its phosphoric acid available.

South Carolina Rock Phosphate.

[Sent on from Ashby, Mass.]

	Per cent.
Moisture at 100° C.,	1.68
Total phosphoric acid,	25.81
Soluble phosphoric acid,	0.27
Reverted phosphoric acid,	0.47
Insoluble phosphoric acid,	25.07
Insoluble matter,	11.64

The material is of fair composition, and ought to be manufactured into superphosphate before used.

Natural Phosphate.

[Sent on from New York.]

	Per cent.
Moisture at 100° C.,	3.26
Total phosphoric acid,	28.95
Reverted phosphoric acid,	1.50
Insoluble phosphoric acid,	27.45
Alumina and ferric oxides,	11.76
Calcium oxide,	35.40

The article is characterized by the presence of a liberal amount of sesquioxide of iron and alumina. Actual field experiments have to decide its agricultural value.

Carib Guano.

[Sent on from Baltimore, Md. I. Rock; coarse. II. Fine-ground. III. Soil.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	2.12	2.16	15.80
Total phosphoric acid,	35.43	33.09	21.72
Soluble phosphoric acid,	–	–	0.12
Reverted phosphoric acid,	3.78	3.49	0.44
Insoluble phosphoric acid,	31.65	29.60	21.16
Total nitrogen,	–	–	0.56
Nitrogen as ammoniates,	–	–	0.28
Nitrogen as nitrates,	–	–	0.26
Calcium oxide,	44.74	43.26	–
Insoluble matter,	0.60	1.59	7.15

The valuation of this material depends in a controlling degree on its mechanical condition.

Superphosphates.

[Sent on from Ashby, Mass. I. and II. Dissolved Bone-black. III. and IV. Acid Phosphate.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	13.83	13.86	16.39	13.93
Total phosphoric acid,	18.21	16.37	14.68	13.84
Soluble phosphoric acid (8 cents per pound),	14.59	14.60	10.50	10.91
Reverted phosphoric acid (7½ cents per pound),	3.41	1.53	3.82	0.69
Insoluble phosphoric acid (3 cents per pound),	0.21	0.24	0.36	2.24
Insoluble matter,	3.52	2.09	7.89	9.54
Valuation per 2,000 pounds,	$28 59	$25 80	$22 75	$19 84

These articles are of fair quality.

Marl.

[I. and II. Sent on from Baltimore, Md. III. Sent on from South Framingham, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	16.70	15.26	12.12
Phosphoric acid,	0.09	0.08	0.35
Sulphuric acid,	1.00	0.31	Trace.
Carbonic acid,	4.23	1.76	–
Calcium oxide,	9.21	5.29	47.11
Magnesium oxide,	0.25	0.16	0.65
Potassium oxide,	0.61	0.37	–
Insoluble matter (before calcination),	59.59	68.86	7.73
Insoluble matter (after calcination),	–	–	7.51

I. and II. Are samples of "green marl;" they belong to a valuable class of marls.

III. This material, sent on "as a sample of marl," is essentially a carbonate of lime of fine aggregation and of a soft texture; and for this reason it deserves recommendation for agricultural purposes, wherever an addition of lime will benefit the soil in the interest of the crops raised upon it.

Peruvian Guano.

[Sent on from Taunton, Mass.]

	Per cent.
Moisture at 100° C.,	12.17
Total phosphoric acid,	18.45
Soluble phosphoric acid (8 cents per pound),	1.54
Reverted phosphoric acid (7½ cents per pound),	5.92
Insoluble phosphoric acid (3 cents per pound),	10.99
Potassium oxide (4¼ cents per pound),	3.46
Total nitrogen,	5.13
Actual ammonia (17½ cents per pound),	3.94
Organic nitrogen (17½ cents per pound),	0.86
Nitrogen as nitric acid (16 cents per pound),	0.33
Insoluble matter,	13.64
Valuation per 2,000 pounds,	$38 74

Compound Fertilizers.

[I. Sent on from Millbury, Mass. II. Sent on by Swanzey Farmers' Club, Swanzey, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	11.83	7.69
Total phosphoric acid,	13.95	9.91
Soluble phosphoric acid,	6.62	2.81
Reverted phosphoric acid,	2.69	3.57
Insoluble phosphoric acid,	4.64	3.53
Potassium oxide,	3.28	10.64
Nitrogen,	2.88	4.62
Insoluble matter,	3.82	1.81
Valuation per 2,000 pounds,	$30 28	$37 19

Compound Fertilizers.

[I. Animal fertilizer; sent on from Boston. II. Sent on from Eastham, Mass. III. Sent on from Tewksbury, Mass. IV. Peruvian guano; sent on from Taunton, Mass.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.20	8.81	14.15	12.17
Total phosphoric acid,	14.51	3.97	13.69	18.45
Soluble phosphoric acid,	6.34	0.25	7.00	1.54
Reverted phosphoric acid,	6.74	2.96	4.83	5.92
Insoluble phosphoric acid,	1.43	0.76	1.86	10.99
Potassium oxide,	5.11	2.97	2.96	3.46
Calcium oxide,	–	–	16.65	–
Total nitrogen,	3.44	1.39	2.40	5.13
Nitrogen in ammoniates,	–	–	–	3.94
Nitrogen in nitrates,	–	–	–	0.33
Nitrogen in organic matter,	–	–	–	0.86
Insoluble matter,	1.23	65.16	5.52	13.64
Valuation per 2,000 pounds,	$37 49	$12 69	$30 49	$38 73

Miscellaneous Analyses.

Vinegars.

[Sent on from Prescott, Mass. I. Made Oct. 5, 1885, from unripe Baldwin apples; shrinkage, 1¼ gals. on 10, or 12½ per cent. II. Made Oct. 28, 1885, from ripe Baldwin apples; shrinkage not determined. III. Made Oct. 28, 1885, from sweet apples; shrinkage, 1 gal. on 7, or 14 2-7 per cent.]

	Per Cent.		
	I.	II.	III.
Temperature, C.,	11.1	11.1	11.1
Specific gravity,	1.016	1.019	1.024
Acetic acid,	6.67	8.41	8.66
Sulphuric acid and chlorine,	Trace.	Trace.	Trace.
Solids at 100° C.,	1.44	1.94	3.02

The tests were made Jan. 24, 1887.

[Two samples, sent on from Montague, Mass.]

	I.	II.
Total acids,	4.90 per cent.	4.55 per cent.

Milk.

[Seven samples; sent on from Hardwick, Mass.]

	Specific Gravity.	Temperature, C.	Per Cent.		
			Solids.	Fat.	Solids not Fat.
No. 1,	1.0338	17°	10.27	1.47	8.80
2,	1.0329	17°	10.02	1.44	8.58
3,	1.0323	17°	9.67	1.31	8.36
4,	1.0323	17°	13.74	4.68	9.06
5,	1.0335	17°	9.19	0.74	8.45
6,	1.0320	17°	11.47	3.01	8.46
7,	1.0311	17°	15.62	7.27	8.35

Analysis of Water sent on for Examination.

[Parts per Million.]

Number.	Actual Ammonia.	Albuminoid Ammonia.	Chlorine.	Solids at 100° C.	Solids at red heat.	Hardness (Clarks' degree).	Lead.	Locality.
I.,	14.80	2.20	148.00	0.682	0.258	19.76	–	Millis.
II.,	–	–	–	–	–	–	None.	No. Amherst.
III.,	0.03	0.14	16.00	130.00	73.2	26.70	–	Westford.
IV.,	2.460	1.620	5.00	0.0396	0.0220	–	–	Millis.
V.,	Contain	ed free	acid, la	rge amou	nts of SO_3.	Traces	of Fe.	Amherst.
VI.,	0.10	0.18	23.30	178.00	112.80	31.20	–	Athol.
VII.,	0.03	0.09	6.00	56.00	45.60	13.50	–	So. Amherst.
VIII.,	0.05	0.16	92.80	462.00	360.00	8.86	–	Rutland.
IX.,	0.69	0.09	55.60	392.00	216.00	7.43	–	Amherst.
X.,	0.15	0.11	10.00	36.00	18.80	1.27	–	Westford.
XI.,	–	–	–	–	–	–	None.	Amherst.
XII.,	0.18	0.36	72.50	584.00	231.00	–	–	Marblehead.
XIII.,	0.04	0.02	21.00	194.00	–	3.66	–	Amherst.
XIV.,	0.34	0.47	18.00	139.00	91.00	3.77	–	Amherst.
XV.,	SO_3—	42.20	7.20	90.00	38.00	CaO —	46.00	Bellows Falls.
XVI.,	0.05	0.10	9.10	164.00	86.00	6.57	–	No. Hadley.
XVII.,	0.10	0.09	6.00	120.00	66.00	6.00	–	No. Hadley.
XVIII.,	0.03	0 08	48.00	166.00	84.00	6.29	–	No Hadley.
XIX.,	4.75	0.20	74.00	706.00	252.00	5.43	–	Amherst.
XX.,	4.72	0.28	56.00	386.00	234.00	5.14	–	Hadley.
XXI.,	0.07	0.04	18.00	214.00	48.00	2.86	–	So. Amherst.
XXII.,	–	0.04	2.00	52.00	20.00	0.48	–	So Amherst.
XXIII.,	0.08	0.15	8.00	132.00	104.00	–	–	Pawtucket, R.I.
XXIV.,	1.225	0.70	11.00	202.00	140.00	–	–	Amherst.
XXV.,	0.07	0.32	9.00	258.00	194.00	–	–	Amherst.
XXVI.,	0.02	0.21	3.50	79.00	37.00	–	–	Amherst.
XXVII.,	–	–	–	–	–	–	Present.	Amherst.
XXVIII.,	0.22	0.18	9.00	66.00	40.00	1.11	–	Attleboro'.
XXIX.,	3.45	0.90	5.40	110.00	70.00	3.90	–	No. Amherst.
XXX.,	0.14	0.08	150.00	652.00	126.00	11.05	–	Amherst.
XXXI.,	–	–	–	–	–	–	Present.	East Amherst.
XXXII.,	–	–	–	–	–	–	Present.	Amherst.
XXXIII.,	–	–	–	–	–	–	None.	East Amherst.
XXXIV.,	–	–	–	–	–	–	None.	Amherst.
XXXV.,	3.50	0.50	73.00	692.00	258.00	11.20	None.	Amherst.
XXXVI.,	0.26	0.26	36.00	344 00	130.00	7.43	–	Springfield.
XXXVII.,	0.48	0.13	13.50	64.00	44.00	–	–	So. Amherst.
XXXVIII.,	0.044	0.098	6.00	50.00	32.00	1.11	None.	Amherst.
XXXIX,	0.12	0.15	None.	22.00	20.00	1.27	–	Westhampton.
XL.,	0.13	0.20	18.00	150.00	86.00	1.95	None.	Athol.

The above-stated results of analyses of drinking waters were obtained from samples sent on, for that purpose, from various parts of the State. In most instances these requests are accompanied by a specified instruction, regarding the object of the party interested, — a circumstance which renders the task of the chemist, comparatively speaking, an easy one.

The analyses have been made according to Wancklyn's process, familiar to chemists; and are directed towards the indications of the presence of chlorine, free and albuminoid ammonia, and the poisonous metals, lead in particular. (For a more detailed description of this method, see "Water Analyses," by J. A. Wancklyn and E. T. Chapman.)

Mr. Wancklyn's interpretation of the results of his mode of investigation is as follows: —

1. Chlorine alone does not necessarily indicate the presence of filthy water.

2. Free and albuminoid ammonia in water, without chlorine, indicates a vegetable source of contamination.

3. More than five grains per gallon* of chlorine (= 71.4 parts per million), accompanied by more than .08 parts per million of free ammonia and more than .10 parts per million of albuminoid ammonia, is a clear indication that the water is contaminated with sewage, decaying animal matter, urine, etc., and should be condemned.

4. Eight-hundredths parts per million of free ammonia and one-tenth part per million of albuminoid ammonia render a water very suspicious, even without much chlorine.

5. Albuminoid ammonia over .15 parts per million ought to absolutely condemn the water which contains it.

6. The total solids found in the water should not exceed forty grains per gallon (571.4 parts per million).

An examination of the above results of analyses shows that Nos. 3, 7, 8, 16, 17, 21, 23 and 25 are of a suspicious character, and that Nos. 1, 4, 6, 9, 10, 12, 14, 19, 20, 24, 28, 30, 35 and 36 ought to be condemned, on account of a large amount of free and albuminoid ammonia, due most likely to access of sewage waters. Of eight samples of

* One gallon equals 70,000 grains.

water tested for lead, three were found to be poisoned by that metal, in consequence of the use of lead pipes.

A satisfactory supply of good drinking water on a farm, depends, in a controlling degree, on a judicious selection of the location of the well designed for the use of the family and for the live-stock, and on the personal attention bestowed, from time to time, on the condition of the well and its surroundings. Good wells are liable to change for the worse at any time, on account of circumstances too numerous to state in this connection. To ascertain, from time to time, the exact condition of the well which supplies the wants of the family and of the live-stock, is a task which no farmer can, for any length of time, discard, without incurring a serious risk to health and prosperity.

The subject receives, quite frequently, but little attention, on account of the fact that the harmful qualities which an apparently good water may contain, are disguised beyond recognition by the unaided senses. Certain delicate chemical tests, aided at times by microscopic observations, are, in the majority of cases, the only reliable means, in our present state of scientific inquiry, by which desirable information regarding the true character of a drinking water can be obtained.

Parties sending on water for an analysis ought to be very careful to use clean vessels, clean stoppers, etc. The sample should be sent on without delay after collecting. One gallon is desirable for the analysis.

COMPILATION OF ANALYSES,

MADE AT THE

AGRICULTURAL INSTITUTIONS AT AMHERST, MASS.,

OF FODDER ARTICLES.

1868–1888.

A. Analyses of Fodder Articles.

B. Analyses of Fodder Articles, with Reference to Fertilizing Ingredients.

"A.'

CORN (ZEA MAIZE).

Fodder Analyses of Kernels.

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Wheeler's Prolific,	B'd of Agricul. '79-80,	10.00	90.00	1.60	2.10	5.24	13.81	77.25	34.	76.	85.	94.	1:7.10
Clark Corn,	" "	10.00	90.00	1.84	2.78	5.40	13.80	76.18	34.	76.	85.	94.	1:7.07
Tip Corn,	" "	10.00	90.00	1.71	2.78	5.77	14.11	75.63	34.	76.	85.	94.	1:7.13
Southern Corn,	" "	10.00	90.00	1.52	2.24	4.93	13.84	77.42	34.	76.	85.	94.	1:7.06
Canada Corn,	" "	10.00	90.00	1.49	2.78	5.28	13.88	76.57	34.	76.	85.	94.	1:7.03
Canada Dutton,	" "	10.00	90.00	1.59	2.78	5.83	12.06	77.74	34.	76.	85.	94.	1:8.30
Early Southern,	" "	10.00	90.00	1.89	2.78	5.53	13.26	76.54	34.	76.	85.	94.	1:7.40
Western (White) Dent,	" "	10.00	90.00	1.53	2.78	4.74	12.81	78 14	34.	76.	85.	94.	1:7.66
Western (Yellow) Dent,	" "	10.00	90.00	1.67	3.33	5.06	12.36	77.53	34.	76.	85.	94.	1:8.91
Crosby Sweet Corn,	" "	10.00	90.00	1.97	2.78	7.72	12.97	74.56	34.	76.	85.	94.	1:7.77
Blue Texas Sweet Corn,	" "	10.00	90.00	1.71	2.78	9.43	15.02	71.06	34.	76.	85.	94.	1:6.71
Nebraska Red Corn,	Report I.,	10.74	89.26	1.44	3.36	6.05	14.16	74.99	34.	76.	85.	94.	1:6 97

Hampden Prolific,	Report II.,	11.43	88.57	1.72	2.17	4 52	11.36	80.23	34.	76.	85.	94.	1: 8.77
Hampden Prolific,	" II.,	8.02	91.98	1.69	1.98	5.29	13.73	77.31	34.	76.	85.	94.	1: 7.15
Topover Corn,	" III.,	11.55	88.45	1.47	1.96	6.61	14.01	75.95	34.	76.	85.	94.	1: 7.11
Yellow Sweet Corn,	" IV.,	10.90	89.10	2.16	2.58	4.25	12.61	78.40	34.	76.	85.	94.	1: 7.74
Self-Husking Corn,	" IV.,	12.10	87.90	1.74	2.52	5.44	12.47	77.83	34.	76.	85.	94.	1: 7.96
Pride of the North,	Bulletin 24,	8.75	91.25	1.59	2.54	4.34	12.05	79.48	34.	76.	85.	94.	1: 8.18
Western Dent,	Bulletin 26,	10.20	89.80	1.47	1.86	4.72	9.31	82.64	34.	76.	85.	94.	1:11.03
Corn Meal,	Report I.,	17.04	82.96	1.58	3.60	4.82	16.08	73.20	34.	76.	85.	94.	1: 5.54
" "	" I.,	13.55	86.45	1.42	2.64	4.24	10.40	81.30	34.	76.	85.	94.	1: 9.66
" "	" II.,	13.85	86.15	1.42	2.64	4.24	10.40	81.30	34.	76.	85.	94.	1: 9.66
" "	" II.,	12.62	87.38	1.56	2.65	4.27	11.43	80.09	34.	76.	85.	94.	1: 8.68
" "	" II.,	11.95	88.05	1.59	2.59	4.43	13.13	78.26	34.	76.	85.	94.	1: 7.42
" "	" II.,	12.40	87.60	1.66	2.71	4.14	10.77	80.72	34.	76.	85.	94.	1: 9.25
" "	" III.,	12.62	87.38	1.56	2.66	4.27	11.43	80.08	34.	76.	85.	94.	1: 8.76
" "	" III.,	11.95	88.05	1.59	2.59	4.43	13.13	78.26	34.	76.	85.	94.	1: 7.42
" "	" IV.,	12.62	87.38	1.56	2.66	4.27	11.43	80.88	34.	76.	85.	94.	1: 8.76
" "	" V.,	13.18	86.82	1.57	3.56	4.86	10.72	79.29	34.	76.	85.	94.	1: 9.33
" "	" V.,	12.98	87.02	1.75	3.42	5.08	10.07	79.63	34.	76.	85.	94.	1:10.17

Fodder Analysis of Corn and Cob (Whole Ear).

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Wheeler's Prolific,	B'd of Agricul. '79-80,	10.00	90.00	1.57	7.39	4.47	12.17	74.40	–	–	–	–	–
Southern Corn,	" "	10.00	90.00	1.37	8.47	4.06	11.78	74.32	–	–	–	–	–
Western (Yellow) Dent,	" "	10.00	90.00	1.57	7.30	4.47	11.13	75.53	–	–	–	–	–
Corn Meal and Cob,	Report I.,	19.07	80.93	1.61	9.77	3.43	15.06	70.13	–	–	–	–	–
Corn-cob Meal,	" IV.,	9.45	90.55	1.64	6.32	5.19	9.85	77.00	–	–	–	–	–
Corn and Cob,	" IV.,	10.71	89.29	2.16	5.39	5.27	12.18	75.00	–	–	–	–	–

Fodder Analysis of Corn Cobs.

Wheeler's Prolific,	B'd of Agricul. '79-80,	10.00	90.00	1.41	33.19	0.67	4.15	60.58	–	–	–	–	–
Southern Corn,	" "	10.00	90.00	0.75	33.39	0.38	3.49	61.99	–	–	–	–	–
Western (Yellow) Dent,	" "	10.00	90.00	0.94	31.36	0.46	3.62	63.62	–	–	–	–	–

Fodder Analysis of Fodder Corn.

Dried Fodder Corn in tassel (frost-bitten),	Report I.,	8.83	91.17	4.86	29 05	2.06	8.63	55.40	72.	75.	73.	67.	1: 9.82
Fodder Corn,	" II.,	6.65	93.35	4.68	31.39	1.42	6.83	55.08	72.	75.	73.	67.	1:12.54
Fodder Corn (frost-bitten),	" II.,	6.67	93.33	5.11	33.75	1.11	6.17	53.86	72.	75.	73.	67.	1:13.88
From unfertilized plats,	" III.,	78.50	21 50	3.91	25.74	2.92	13.75	53.68	72.	75.	73.	67.	1: 5.97
Fodder Corn,													
Collected July 22,	" III.,	88.61	11.39	8.54	26.01	3.24	17.19	42.02	72.	75.	73.	67.	1: 4.22
" July 29,	" III.,	85.76	14.24	8.00	27.29	2.65	14.42	47.64	72.	75.	73.	67.	1: 5.37
" Aug. 5,	" III.,	84.64	15.36	5.95	26.40	2.26	11.86	53.53	72.	75.	73.	67.	1: 6.83
" Aug. 13,	" III.,	82.08	17.92	5.69	24.11	2.13	11.23	56.84	72.	75.	73.	67.	1: 7.25
" Aug. 27,	" III.,	81.15	18.85	4.70	24.30	1.81	8.87	60.32	72.	75.	73.	67.	1: 9.46
" Sept. 3,	" III.,	76.81	23.19	4.22	20.93	2.63	9.17	63.05	72.	75.	73.	67.	1: 9.30
Collected Sept. 1,	" V.,	72.27	27.73	3.16	24.32	2.89	9.64	59.99	72.	75.	73.	67.	1: 8.97
Kernels glazed,													
Fodder Corn for Ensilage,	" V.,	70.27	29.73	5.24	24.50	3.38	8.36	58.52	72.	75.	73.	67.	1:10.36

Fodder Analysis of Corn Fodder (Stover).

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Corn Stover,	Report II.,	8.73	91.27	3.12	34.28	1.27	6.58	54.75	–	30.	40.	100.	1:21.16
Shredded Stover,	" III.,	6.95	93.05	5.16	33.46	1.71	12.15	47.52	72.	75.	73.	67.	1: 7.23
Corn Fodder,	" IV.,	15.40	84.60	4.22	20.93	2.63	9.17	63.05	72.	75.	73.	67.	1: 9 3
Western Dent Stover,	Bulletin 26,	16.67	83.33	4.17	35.44	1.71	6.63	52.05	72.	75.	73.	67.	1:13.14
"Topover Corn" Stover,	Report III.,	25.00	75.00	6.12	36.10	2.49	0.47	48.82	72.	75.	73.	67.	1:13.43

Fodder Analysis of Ensilage (from Fodder Corn).

Corn Ensilage,	Board of Agricul. '80,	80.70	19.30	9.17	33.52	3.21	8.08	46.22	72.	75.	73.	67.	1:10.34
Ensilage of Corn in Tassel,	Report II.,	86.88	13.12	6.89	33.66	3.88	12.58	42.99	72.	75.	73.	67.	1: 6.57
Ensilage of Cut Corn,	" III.,	81.88	18.12	5.07	26.23	3.49	7.83	57.38	72.	75.	73.	67.	1:11.8
Ensilage of Whole Corn,	" III.,	83.18	16.82	4.23	29.44	3.69	9.03	53.61	72.	75.	73.	67.	1: 9.71
Corn Ensilage,	" IV.,	77.48	22.52	4.19	19.08	3.49	7.82	65.42	72.	75.	73.	67.	1:11.3

Corn Ensilage,	" IV.,	78.05	21.95	3.16	20 48	3.84	7.37	65.15	72.	75.	73.	67.	1:12.2
Corn Ensilage,	" IV.,	76.90	23.10	5.22	17.67	3.15	8.27	65.69	72.	75.	73.	67.	1:10.4
Corn Ensilage,	Bulletin 26,	71.60	28.40	3.32	18.52	6.07	7.78	64.31	72.	75.	73.	67.	1:11.9

Fodder Analysis of Gluten Meal.

Gluten Meal,	Report I,	8.43	91.57	0.64	3.55	8.75	38.22	48.84	34.	76.	85.	94.	1:1.96
" "	" I.,	10.23	89.77	0.65	1.20	5.06	33.56	59.53	34.	76.	85.	94.	1:2.31
" "	" II.,	11.68	88.32	0.79	.77	3.94	28.24	66.26	34.	76.	85.	94.	1:2.92
" "	" III.,	8.45	91.55	0.76	1.73	9.34	35.31	52.86	34.	76.	85.	94.	1:2.27
" "	" IV.,	8.95	91.05	0.76	1.58	7.51	30.81	59.34	34.	76.	85.	94.	1:3.00
" "	" V.,	8.83	91.17	0.73	.79	8.46	31.43	58.59	34.	76.	85.	94.	1:2.67
" "	" V.,	10.04	89.96	0.78	4.45	9.34	34.67	50.76	34.	76.	85.	94.	1:2.27

Fodder Analysis of Corn Refuse from Factories.

Hominy Feed, Chit and soft parts of Kernels of Corn,	Report I.,	8.93	91.07	2.07	3.77	4.89	11.20	78.07	–	–	–	–	–
Hominy Meal,	" III.,	8.11	91.89	3.24	4.78	12.22	11.76	68.00	34.	76.	85.	94.	1:9.28
Hominy Meal,	" IV.,	10.70	89.30	2.82	3.69	10.88	11.88	70.73	34.	76.	85.	94.	1:8.75
Corn Refuse from Starch Factory,	" IV.,	57.04	42.96	0.90	7.54	10.17	22.41	58.98	–	–	–	–	–
Chit Corn Meal,	" V.,	12.32	87.68	2.08	3.92	5.74	10.26	78.00	–	–	–	–	–
Cracked Corn, Chits removed,	" V.,	13.58	86.42	2.64	3.15	4.06	10.99	79.16	–	–	–	–	–

WHEAT.

Fodder Analysis of Wheat Grain.

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Wheat Grain,	Report II.,	10.58	89.42	2.18	2.42	1.79	13.35	80.26	–	80.	90.	92.5	1:6.42

Fodder Analysis of Wheat Straw.

Wheat Straw,	Report II.,	6.20	93.80	4.80	35.91	1.63	7.20	50.46	–	42.	60.	65.	1:8.

Fodder Analysis of Wheat Bran.

Wheat Bran,	Report I.,	13.70	86.30	6.76	9.33	2.91	19.56	61.44	20.	80.	88.	80.	1:3.30
" "	" I.,	12.08	87.92	7.92	13.72	3.81	15.67	58.88	20.	80.	88.	80.	1:4.16
" "	" II.,	10.48	89.52	6.98	10.20	4.77	20.24	57.81	20.	80.	88.	80.	1:3.25
" "	" III.,	12.05	87.95	6.64	11.49	4.75	17.86	59.26	20.	80.	88.	80.	1:3.77
" "	" IV.,	10.00	90.00	6.11	7.60	6.08	18.63	61.58	20.	80.	88.	80.	1:3.84
" "	" V.,	12.20	87.80	7.33	10.92	2.80	19.79	59.16	20.	80.	88.	80.	1:3.16
" "	" V.,	11.14	88.86	6.59	12.80	6.00	17.72	56.89	20.	80.	88.	80.	1:3.85
" "	" V.,	10.38	89.62	6.92	14.26	4.81	16.25	57.76	20.	80.	88.	80.	1:4.10

Fodder Analysis of Wheat Middlings.

Wheat Middlings,	Report III.,	9.25	90.75	5.34	8.40	6.46	18.18	61.62	20.	80.	88.	80.	1:3.99
" "	" IV.,	10.55	89.45	2.49	1.40	4.26	19.21	72.64	20.	80.	88.	80.	1:3.97
" "	" IV.,	9.85	90.15	2.53	2.75	3.19	17.23	74.30	20.	80.	88.	80.	1:4.38

Fodder Analysis of Rye Bran and Middlings.

Rye Bran,	Report I.,	13.70	86.30	5.17	4.54	2.07	18.98	69.24	9.	57.5	66.	74.5	1:4.39
Rye Bran,	" IV.,	8.18	91.82	3.43	3.46	3.03	16.52	73.56	9.	57.5	66.	74.5	1:5.45
Rye Middlings,	Bulletin 27,	12.54	87.46	4.02	3.70	5.61	13.15	73.52	9.	57.5	66.	74.5	1:7.28

Fodder Analysis of Various Fodder Stuffs.

Broom Corn Seed Meal,	Report V.,	13.54	86.46	2.43	8.00	4.13	11.14	74.30	-	-	-	-	-
Broom Corn Seed,	" V.,	14.10	85.90	2.35	8.34	4.05	11.21	74.05	-	-	-	-	-
Broom Corn Waste,	" V.,	8.70	91.30	4.88	39.25	1.00	6.78	48.09	-	-	-	-	-
Linseed Cake,	" I.,	8.35	91.65	7.52	8.69	5.69	37.25	40.85	26.	91.	87.	91.	1:1.62
Cocoa Dust, Refuse from Cocoa Manufactories,	" I.,	7.10	92.90	6.83	5.86	25.85	15.47	45.99	-	-	-	-	-
Pea Meal, Refuse from Pea-splitting Manufactories,	" V.,	8.85	91.15	2.94	19.42	1.67	20.95	55.02	-	-	-	-	-

Fodder Analysis of Cotton-seed Meal.

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Cotton-seed Meal,	Report I.,	9.13	90.87	7.61	6.28	12.83	47.04	26.24	23.	91.	74.	46.	1:1.23
" " "	" I.,	8.38	91.62	8.51	6.73	12.94	42.47	29.35	23.	91.	74.	46.	1:1.41
" " "	" I.,	7.10	92.90	9.34	7.53	13.75	42.50	26.80	23.	91.	74.	46.	1:1.44
" " "	" I.,	8.15	91.85	7.46	7.41	14.72	36.54	33.87	23.	91.	74.	46.	1:1.88
" " "	" I.,	7.09	92.91	9.15	10.53	13.65	41.64	25.03	23.	91.	74.	46.	1:1.46

Fodder Analysis of Ensilage from Various Materials.

Corn and Cob before entering silo,	Report IV.,	10.71	89.29	2.16	5.39	5.27	12.18	75.00	-	-	-	-	-
Same, ensilaged whole,	" IV.,	25.50	74.50	1.43	8.32	8.66	10.56	71.03	-	-	-	-	-
Same, cut and ensilaged,	" IV.,	50.27	49.73	1.35	8.50	7.84	6.63	75.68	-	-	-	-	-
Rowen, dried in field,	" IV.,	19.71	80.29	8.99	29.43	4.96	14.70	41.92	-	-	-	-	-
Rowen, after being in silo eleven months,	" IV.,	18.44	81.56	8.76	27.93	6.98	12.34	43.99	-	-	-	-	-
Sweet Corn,	Bulletin 26,	-	-	5.66	24.21	5.19	10.10	54.84	-	-	-	-	-

Fodder Analysis of Grasses.

English Hay, cut June 20. Last stage of blooming,	Report III.,	10.55	89.45	4.69	29.21	2.65	9.02	54.43	58.	46.	57.	63.	1:10.6
Hay from Station,	" III.,	8.30	91.70	6.12	30.19	2.55	9.75	51.39	58.	46.	57.	63.	1: 9.5
Hay from Station, '87,	" V.,	10.78	89.22	7.11	35.55	2.63	8.75	45.96	58.	46.	57.	63.	1:10.55
Rowen,	Report IV.,	19.71	80.29	8.99	29.43	4.96	14.70	41.92	58.	46.	57.	63.	1: 5.87
Rowen, Station, '87,	" V.,	8.84	91.16	10.50	29.46	3.05	13.20	43.79	58.	46.	57.	63.	1: 6.41
Herd's Grass or Timothy, fertilized,	Bulletin 24,	65.74	34.26	5.29	33.23	1.95	8.20	51.33	58.	46.	57.	63.	1:11.52
Herd's Grass or Timothy, unfertilized, collected in bloom,	Bulletin 26,	65.00	35.00	5.37	32.50	2.07	8.83	51.23	58.	46.	57.	63.	1:11.86
Timothy, after blooming,	Report I.,	8.70	91.30	4.04	36.59	2.12	7.24	50.01	58.	46.	57.	63.	1:14.83
Timothy, after blooming,	" II.,	10.55	89.45	4.69	29.21	2.65	9.02	54.43	58.	46.	57.	63.	1:10.6
Red Top.													
Collected July 22. Fertilized,	Report V.,	8.24	91.76	4.84	33.49	1.50	6.41	53.76	58.	46.	57.	63.	1:15.07
" July 22. Unfertilized,	" V.,	8.02	91.98	4.17	31.12	1.69	8.28	54.74	58.	46.	57.	63.	1:11 54
" July 5. Fertilized,	" V.,	6.81	93.19	5.69	34.11	1.56	8.32	50.32	58.	46.	57.	63.	1:11.24
" July 5. Unfertilized,	" V.,	7.75	92.25	5.17	32.95	1.64	8.40	51.84	58.	46.	57.	63.	1:11.20

Fodder Analysis of Grasses—Continued.

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Orchard Grass.													
Collected June 7, in bloom, unfertilized,	Report V.,	9.16	90.86	8.67	34.15	2.40	11.29	43.50	58.	46.	57.	63.	1: 7.77
Same, fertilized,	" V.,	9.09	90.91	7.90	34.12	2.41	8.94	46.63	58.	46.	57.	63.	1:10.18
Collected June 30, in seed, unfertilized,	" V.,	8.72	91.28	5.46	35.79	3.26	8.15	47.34	58.	46.	57.	63.	1:11.67
Same, fertilized,	" V.,	8.38	91.62	6.17	35.48	3.56	7.57	47.22	58.	46.	57.	63.	1:12.63
Barnyard Grass.													
Collected, in bloom, Aug. 14,	Report II.,	6.65	93.35	10.82	33.72	1.95	15.27	38.24	-	42.	60.	65.	1: 2.94
Meadow Fescue.													
Collected June 28, fertilized,	Report V.,	7.40	92.60	7.17	34.46	2.17	7.02	49.18	58.	46.	57.	63.	1:13.49
Collected June 28, unfertilized,	" V.,	8.03	91.97	8.18	34.61	1.78	7.27	48.16	58.	46.	57.	63.	1:12.67
Common Millet, in bloom,	Report II.,	6.15	93.85	4.67	29.80	2.04	7.69	55.80	-	42.	60.	65.	1: 8.32
Common Millet, matured,	" II.,	6.73	93.27	4.23	33.39	2.67	7.09	52.62	-	42.	60.	60.	1: 8.5
Pearl Millet, in bloom,	" II.,	6.20	93.80	4.80	35.91	1.63	7.20	50.46	-	42.	60.	65.	1: 8.

Pearl Millet, fertilized, collected Sept. 10,	Report III.,	7.80	92.20	6.68	34.31	1.47	7.88	49.66	–	42.	60.	65.	1: 7.15
Pearl Millet, unfertilized, collected Sept. 10,	" III.,	8.10	91.90	7.08	34.30	0.89	8.11	49.62	–	42.	60.	65.	1: 6.8
Hungarian Grass,	" II.,	7.45	92.55	5.73	31.96	2.22	9.45	50.64	–	42.	60.	65.	1: 6.22
Hungarian Grass, in bloom,	" III.,	74.07	25.93	7.15	24 66	1.01	9.38	57.80	–	42.	60.	65.	1: 6.86
Hay of Ripe Oats,	" I.,	8.70	91.30	6 11	36.31	2.61	6.05	48.92	–	46.	57.	100.	1:15.03
Hay of Oats, in blossom,	" I.,	6.43	93.57	6.41	34.06	2.92	6 58	50 03	–	46.	57.	100.	1:14.23
Hay of Oats, Seeds in milk,	" III.,	9.55	90.45	6.08	34.32	2.69	10.89	46.02	–	46.	57.	100.	1: 7.9
Green Oats, in blossom, collected July 5,	Bulletin 24,	78.61	21.39	7 38	33.12	2.02	7.10	50.38	–	46.	57.	100.	1:13.02
Green Oats, collected July 13,	" 24,	71.18	28.82	6.99	32.83	2.44	7.05	50.69	–	46.	57.	100.	1:13.32
Hay of Winter Rye, in full bloom, May 25,	Report I.,	8.55	91.45	6.40	32.97	2.57	10.66	47.40	–	46.	57.	100.	1: 8.28
Hay of Barley, Seeds in milk,	" III.,	10.25	89.75	4.95	29.12	2.76	10.26	52.91	–	46.	57.	100.	1: 9.59

Fodder Analyses of Leguminous Plants.

Alsyke Clover, unfertilized, collected Aug. 16,	Report V.,	8.30	91.70	13.35	21.44	3.26	17.32	44.63	–	–	–	–	–
Alsyke Clover, fertilized, collected Aug. 16,	" V.,	8.64	91.36	10.92	26.28	2.89	14.97	44.94	–	–	–	–	–
Luzerne (Alfalfa), beginning to bloom,	" III.,	16.00	84.00	10.45	25.42	2.50	16.34	45.29	40.	39.	77.	65.	1: 4.71
Sand Luzerne, in bloom,	" III.,	8.80	91.20	9.57	21.27	2.59	16.26	50.31	40.	39.	77.	65.	1: 3.5
Luzerne (Alfalfa); unfertilized, collected Aug. 16,	" V.,	8.41	91.59	7.83	27.86	2.04	12.96	49.31	40.	39.	77.	65.	1: 4.55

Fodder Analysis of Leguminous Plants—Concluded

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Luzerne (Alfalfa); fertilized, collected Aug. 16,	Report V.,	8.33	91.67	7.18	28.54	1.54	11.12	51 62	40.	39.	77.	65.	1: 5.43
Vetch, collected in bloom,	" III.,	8.35	91.65	7.97	30.68	2.30	15.76	43.29	54.	60.	76.	65.	1: 4.02
Vetch, collected fully matured,	" III.,	9.45	90.55	8.50	30.05	2.69	14.42	44.34	45.	60.	71.	55.	1: 4.09
Vetch and Oats by weight; 90 per cent. Oats and 10 per cent. Vetch,	" V.,	86.11	13.89	12.37	34.20	2.74	10.59	40.10	–	50.	60.	100.	1: 6.85
Cow Pea, variety, Clay; collected Aug. 1,	" II.,	9.30	90.70	9.53	23.58	3.81	17.02	46.06	47.	59.	60.	69.	1: 4.75
Cow Pea, variety, Whippoorwill; collected Aug. 1,	" II.,	9.65	90.35	10.46	22.36	3.87	16.95	46.36	47.	59.	60.	69.	1: 4.74
Cow Pea, same as previous, mixed with Oats,	" II.,	9.75	90.25	7.87	19.06	4.49	17.17	51.41	47.	59.	60.	69.	1: 4.95
Cow pea, collected Sept. 2,	" V.,	78.81	21.19	5.97	23.02	1.81	8.58	60.62	47.	59.	60.	69.	1:11.71
Serradella, cut in bloom,	" II.,	7.20	92.80	5.87	24.37	2.37	17.85	49.54	–	60.	63.	100	1: 4.72
Serradella, fully matured,	" II.,	8.70	91.30	6.46	25.14	2.91	15.26	50.23	47.	50.	60.	69.	1: 5.47
Serradella, collected when in bloom,	Bulletin 24,	84.60	15.40	11.85	26.21	2.65	17.75	41.54	–	60.	63.	100.	1: 4.07

Serradella, collected Sept. 20, matured,	Report V.,	80.58	19.42	11.53	38.76	2.09	12.17	35.45	47.	50.	60.	69.	1: 6.20
White Lupine, in bloom,	" III.,	85.35	14.65	5.03	31.18	2.41	18.71	42.67	–	–	–	–	–
Horse-bean Straw, collected Sept. 15,	" II.,	9.15	90.85	9.59	41.44	1.51	9.69	37.77	36. (Ratio	55. of Be	51. ans to	61. Straw,	1: 8.55 46:54.)
Horse-bean Straw (Beans), collected Sept. 15,	" II.,	10.28	89.72	4.27	8.11	1.11	30.03	56.48	63.	97.	90.	94.	1: 2.24
Whole Plant, Horse-bean, collected in bloom,	" III.,	84.83	15.17	5.75	28.17	2.31	16.68	47.09	–	67.	71.	60.	1: 2.71

Fodder Analyses of Roots.

Vilmorin Sugar Beet,	Report III.,	84.25	15.75	4.65	6.98	0.64	12.98	74.75	100.	100.	75.	95.	1: 8.17
" " "	" III.,	83.55	16.45	4.53	6.75	0.68	10.14	77.90	100.	100.	75.	95.	1:10.84
" " "	" III.,	80.47	19.53	3.85	6.45	0.58	16.13	72.79	100.	100.	75.	95.	1: 6.37
" " "	" III.,	85.99	14.01	4.27	5.77	0.61	15.75	73.60	100.	100.	75.	95.	1: 6.49
Lane's Improved Sugar Beet,	" III.,	83.57	16.43	3.57	5 27	0.83	17.44	72.89	100.	100.	75.	95.	1: 5.86
Sugar-beet Pulp, refuse from diffusion method,	" II.,	89.68	10.32	1.04	23.74	0.95	12.41	61.86	100.	100.	100.	100.	1: 7.1
Carrots (Danvers),	" III.,	87.48	12.52	4.92	7.55	3.94	9.63	73.96	100.	100.	100.	100.	1: 9.49
Carrots,	Bulletin 26,	90.02	9.98	11.21	10.76	1.89	8.90	67.24	100.	100.	100.	100.	1: 9.24
Southern Prize Turnip,	Report III.,	91.77	8.23	7.85	10.12	1.74	9.67	70.62	100.	100.	57.	88.7	1: 8.8
Yellow Globe Mangold,	" III.,	88.27	11.73	7.83	7.08	0.73	12.84	71.52	100.	100.	75.	95.	1: 6.26

Fodder Analyses — Concluded.

VARIETY.	Source of Analysis.	Moisture.	Dry Matter.	Analysis of Dry Matter, 100 Parts.					Per Cent. of Digestibility.				Nutritive Ratio.
				Crude Ash.	Crude Cellulose.	Crude Fat.	Crude Protein (Nitrogenous Matter).	Non-nitrogenous Extract Matter.	Crude Cellulose.	Crude Fat.	Crude Protein.	Non-nitrogenous Extract Matter.	
Potato, fertilized, not matured fully, ...	Report III., . . .	78.05	21.95	4.63	1.98	0.83	13.56	79.00	100.	100.	65.	93.	1: 6.13
R. I. Greening Apples, . . .	" III., . . .	80.32	19.68	2.13	7.05	2.81	4.57	83.44	-	-	75.	100.	1:24.3
Sweet Apples, ...	" III., . . .	75.17	24.83	2.02	6.14	1.71	3.92	86.21	-	-	-	-	-
Apple Pomace, R. I. Greening, .	" III., . . .	78.22	21.78	1.09	16.58	3.19	6.94	70.20	-	-	-	-	-
Apple Pomace of Baldwin, . .	" III., . . .	82.78	17.22	1.82	13.15	4.37	7.73	72.93	-	-	-	-	-
Apple Pomace, Ensilage, . .	" IV., . . .	85.33	14.67	4.21	22.18	7.36	8.22	58.03	-	-	-	-	-

"B."

Fertilizing Ingredients in Corn (Zea Maize; Kernels).

VARIETY.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Potassium Oxide.	Calcium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Silica.	Nitrogen.	Valuation per Ton.*
Wheeler's Prolific,	Mass. Board of Agricul. '79–80,	10.00	-	.773	.369	.015	.210	.031	.013	.018	1.99	$7 91
Southern Corn,	" " "	10.00	-	.719	.383	.014	.212	.026	.011	.005	1.99	7 86
Canada Corn,	" " "	10.00	-	.743	.309	.024	.175	.057	.013	.004	2.00	7 95
Canada Dutton,	" " "	10.00	-	.738	.421	.015	.208	-	.030	.011	1.74	7 16
Western (Yellow) Dent,	" " "	10.00	-	.679	.466	.024	.237	.049	.005	.039	1.78	7 27
Crosby Sweet Corn,	" " "	10.00	-	.742	.712	.032	.222	.021	.003	.027	1.87	7 86
Corn Meal,	Report II.,	17.04	-	.644	.419	.040	.176	-	-	-	2.23	8 71
Corn Meal,	" IV.,	10.00	-	.770	.450	.027	.197	.064	.015	.005	1.86	7 62

Fertilizing Ingredients in Corn and Cob.

Wheeler's Prolific,	Board of Agricul. '79–80,	10.00	1.4116	.676	.433	.017	.198	.038	Trace.	.050	1.752	$7 18
Southern Corn,	" "	10.00	1.2317	.575	.390	.015	.173	.033	.010	.035	1.696	6 79
Western (Yellow) Dent,	" "	10.00	1.4087	.575	.474	.024	.203	.054	.005	.073	1.602	6 54

* On basis of valuation for 1887, nitrogen 17 cents, phosphoric acid 6 cents, potassium oxide 4¼ cents, per pound.

Fertilizing Ingredients in Corn Cobs.

VARIETY.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Potassium Oxide.	Calcium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Silica.	Nitrogen.	Valuation per Ton.
Wheeler's Prolific,	B'd of Agricul. '79-80.	10.00	1.2729	.117	.765	.028	.068	.073	Trace.	.220	.597	$2 82
Southern Corn,	" "	10.00	0.6783	.054	.406	.021	.031	.016	.008	.141	.503	2 23
Canada Corn,	" "	10.00	0.1629	.017	.102	.004	.008	.005	.011	.017	-	-
Canada Dutton Corn,	" "	10.00	1.1485	.054	.906	.057	.110	-	.020	-	-	-
Western (Yellow) Dent,	" "	10.00	0.8494	.043	.461	.019	.034	.071	.005	.216	.521	2 21
Longfellow,	Report II.,	12.00	1.3800	.075	.909	.036	.044	.031	.016	.269	-	-
Corn Cobs,	" IV.,	10.00	1.0300	.080	.680	.030	.060	.040	.010	.200	.540	2 52

Fertilizing Ingredients in Fodder Corn.

CONDITIONS.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Insoluble Matter.	Nitrogen.	Valuation per Ton.
Unfertilized,	Report III.,	None.	3.49	.526	.455	.507	.544	.268	.058	1.123	1.96	$7 72
Fertilized with muriate of potash,	" III.,	"	6.26	.397	.545	1.259	.488	.157	.071	1.614	1.77	7 57
" " dissolved bone-black,	" III.,	"	4.92	.630	.789	.479	.770	.070	.090	1.990	1.99	7 93

Fertilized with sulphate ammonia,	Report III.,	None.	5.080	.600	.600	.520	.810	.060	.050	1.190	2.01	$7 99
Fodder Corn, kernels glazed,	" V.,	72.27	–	.40	.54	1.09	.16	.15	–	1.35	1.25	1 69
" " green,	" V.,	79.27	–	.13	.18	.36	.05	.05	–	.45	.47	1 86

Fertilizing Ingredients in Ensilage (from Fodder Corn).

CONDITIONS AND STAGE OF GROWTH.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Insoluble Matter.	Nitrogen.	Valuation per Ton.
Ensilage from Corn, kernels glazed,	Bulletin 26,	71.60	–	.14	.10	.33	.09	.05	.02	.04	.36	$1 68

Fertilizing Ingredients in Gluten Meal.

VARIETY.	Source of Analysis.	Sulphuric Acid.	Moisture.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Nitrogen.	Valuation per Ton.
Gluten Meal,	Report I.,	.0215	8.43	.586	.4512	.0582	.0564	.0346	–	–	5.5997	$19 63
" "	" IV.,	.021	9.00	.700	.45	.058	.06	.034	–	–	5.44	19 05
" "	" V.,	–	8.83	.666	.295	.036	.034	.026	.018	.048	4.62	16 09

Fertilizing Ingredients in Hominy Feed.

VARIETY.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Insoluble Matter.	Nitrogen.	Valuation per Ton.
Hominy Feed, ...	Report I., . . .	8.93	1.89	.98	.18	.49	.28	–	–	–	1.63	$6 14

Fertilizing Ingredients in Wheat (Wheat Meal).

Wheat Meal, ...	Report IV., . . .	9.83	1.22	.57	.17	.54	.05	1.06	–	–	2.21	$8 65

Fertilizing Ingredients in Wheat Bran.

Wheat Bran, ...	Report III., . . .	–	–	2.46	.26	1.95	.89	.37	–	.14	2.86	$14 91
" "	" IV., . . .	11.45	–	3.05	–	1.49	.90	.09	–	.11	2.82	14 52
" "	" IV., . . .	9.40	–	3.12	–	1.42	.91	.16	–	.15	3.08	15 42
" "	" V., . . .	12.20	6.44	2.84	.14	1.62	.91	.09	.02	.13	2.78	14 24

Fertilizing Ingredients in Wheat Middlings.

Wheat Middlings, ...	Report IV., . . .	9.18	2.30	.95	.20	.63	.21	.11	–	–	2.63	$10 63

Fertilizing Ingredients in Rye Middlings.

Rye Middlings,	Report V.,	12.54	3.52	1.26	.09	.81	.32	.03	.02	.17	1.84	$8 46

Fertilizing Ingredients of Various Fodder Stuffs.

Linseed Cake,	Report I.,	8.35	6.89	1.86	0.64	1.43	0.77	–	–	–	5.462	$22 01
Cocoa Dust,	" I.,	7.10	6.35	1.34	0.63	2.11	Traces.	–	–	–	2.299	11 22
Pea Meal,	" V.,	8.85	–	0.82	0.302	0.993	0.302	0.618	0.027	0.122	3.08	11 31
Broom Corn Waste, stalks,	" V.,	10.37	4.70	0.460	0.242	1.858	0.170	–	–	1.000	0.87	5 09

Fertilizing Ingredients of Cotton-seed Meal.

VARIETY.	Source of Analysis.	Moisture.	Organic and Volatile Matter.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Insoluble Matter.	Nitrogen.	Valuation per Ton.
Cotton-seed Meal, coarse portion,	Report I.,	7.09	93.465	6.535	2.341	2.63	1.797	2.23	–	1.784	5.90	$24 40
" " " " "	" III.,	6.80	94.230	5.77	1.45	0.39	0.89	0.99	–	0.600	6.10	24 46
" " " (damaged),	" IV.,	9.90	–	–	1.26	0.22	1.21	0.56	–	0.200	3.73	14 97
" " "	" V.,	7.71	92.71	7.29	2.01	0.27	2.09	1.13	–	0.06	4.02	17 86

Fertilizing Ingredients in Various Grasses and Leguminous Plants.

VARIETY.	Source of Analysis.	Moisture.	Ash.	Phosphoric Acid.	Calcium Oxide.	Potassium Oxide.	Magnesium Oxide.	Sodium Oxide.	Ferric Oxide.	Insoluble Matter.	Nitrogen.	Valuation per Ton.
Hay from Station, 1887,	Report V.,	10.78	6.34	.464	.521	2.085	.284	.064	.032	1.37	1.25	$6 58
Rowen from Station, 1887,	" V.,	8.84	9.57	.364	.853	2.860	.197	.122	.057	2.18	1.93	9 50
Herd's Grass, fertilized, collected in bloom,	Bulletin 24,	7.80	4.88	.36	.44	1.63	.12	.08	–	1.01	1.21	5 93
Same, unfertilized,	" 26,	7.24	4.98	.56	.99	1.44	.09	.37	–	1.33	1.31	6 35
Redtop, fertilized, collected July 22,	Report V.,	8.24	4.44	3.52	.451	1.169	.149	.829	.038	1.710	.94	4 61
" unfertilized, collected July 22,	" V.,	8.02	3 84	3.26	.575	.659	.111	.317	.060	1.836	1.21	5 07
" collected July 5, fertilized,	" V.,	6.81	5.30	.377	.614	1.206	.125	.180	.024	1.716	1 19	5 53
" collected July 5, unfertilized,	" V.,	7.75	4.77	.391	.645	1.054	.149	.425	.033	1.683	1.24	5 59
Orchard Grass, in bloom, unfertilized,	" V.,	9.16	7.88	.399	.457	2.114	.236	.233	.021	1.976	1.64	7 86
" " in bloom, fertilized,	" V.,	9.09	7.18	.483	.401	2.330	.255	.211	.014	1.867	1.30	6 99
" " in seed, unfertilized,	" V.,	8.72	4.98	.444	.470	1.303	.505	.211	.034	2.116	1.19	5 69
" " in seed, fertilized,	" V.,	8.38	5.65	.329	.496	1.758	.192	.216	.063	2.28	1.11	5 66
Meadow Fescue, collected June 23,	" V.,	7.40	6.64	.230	.540	1.815	.110	.080	.027	1.403	1.04	5 36
" " collected June 28,	" V.,	8.03	7.52	.229	.466	2.183	.136	.139	.025	1.961	1.07	5 87
Vetch and Oats,	" V.,	86.11	1.72	0.094	0.087	0.789	.030	0.031	.012	0.331	2.25	1 58
Cow Pea, collected Sept. 2,	" V.,	78.81	–	0.093	0.300	0.306	.099	0.063	.016	0.077	0.29	1 51

Serradella, in bloom (Hay),	Bulletin 24,	Green,	84.60	1.82	0.155	0.453	0.448	.067	0.095	–	0.036	0.437	2 06
		Hay,	10.54	10.60	0.90	2.63	0.260	.39	0.55	–	0.21	2.54	11 93
Serradella, collected Sept. 20 (Green),	Report V.,		80.58	–	0.124	0.472	0.398	.067	0.098	.021	0.157	0.385	1 80
White Lupine, in bloom,	" III.,		85.35	0.74	0.35	3.07	1.73	.73	0.68	.17	0.90	0.44	3 39
Horse Bean, whole plant, collected in bloom,	" III.,		74.71	–	0.33	1.37	1.37	.62	0.09	.20	2.04	0.675	3 87
Alsyke Clover, unfertilized, collected Aug. 16,	" V.,		8.30	12.24	0.584	1.836	1.605	.610	0.570	.246	3.241	2.54	10 70
Alsyke Clover, fertilized, collected Aug. 16,	" V.,		8.64	9.98	1.016	1.644	2.740	.735	0.236	.417	3.226	2.19	11 00
Luzerne (Alfalfa), unfertilized, collected Aug. 26,	" V.,		8.41	7.17	0.458	2.558	0.872	.582	1.354	.085	0.687	1.90	7 65
Luzerne (Alfalfa), fertilized, collected Aug. 26,	" V.,		8.33	6.58	0.444	1.486	2.043	.249	0.668	.105	0.716	1.63	7 81

Fertilizing Ingredients in Roots and Fruits.

Vilmorin Sugar Beet,	Report IV.,	85.99	.62	.03	.06	.18	.04	.18	.01	.10	.29	$1 18
Carrots,	Bulletin 26,	90.02	–	.10	.07	.54	.02	.11	.01	.01	.14	1 06
R. I. Greening Apples,	Report IV.,	84.65	.327	.008	.023	.122	.025	.013	.001	.002	.113	0 49
Sweet Apples,	" IV.,	75.17	.501	.011	.044	.269	.029	.042	.005	.004	.156	0 60
Apple Pomace, Baldwin,	" IV.,	82.78	.306	.018	.032	.150	.028	.020	.008	.008	.213	0 87
" " R. I. Greening,	" IV.,	78.22	.237	.017	.042	.119	.027	.032	.008	.009	.241	0 92

Compilation of Analyses made at Amherst, Mass., of Agricultural Chemicals and Refuse Materials used for Fertilizing Purposes.*

As the basis of Valuation changes from year to year, no Valuation is stated.

1868 to 1888.

Muriate of Potash (43 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	4.05	0.05	2.05	
Potassium oxide,	58.98	45.94	52.46	
Sodium oxide,	11.26	2.13	6.69	
Magnesium oxide,	0.90	0.30	0.55	
Chlorine,	54.00	43.20	48.60	
Insoluble matter,	2.00	0.15	0.75	

Sulphate of Potash (14 Analyses).

Moisture at 100° C.,	5.00	0.19	1.00
Potassium oxide,	51.28	20.44	35.86
Sodium oxide,	8.59	0.34	4.46
Magnesium oxide,	2.63	0.24	1.50
Sulphuric acid,	59.30	10.86	45.00
Insoluble matter,	31.55	0.14	0.75

* This compilation does not include the analyses made of licensed fertilizers. They are to be found in the Reports of the State Inspector of Fertilizers from 1873 to 1888, contained in the Reports of the Secretary of the Massachusetts State Board of Agriculture for those years. C. A. G.

Sulphate of Potash and Magnesia (12 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	11.58	1.95	5.50	
Potassium oxide,	27.77	11.70	22.50	
Sodium oxide,	18.97	2.09	6.50	
Magnesium oxide,	13.66	10.86	12.25	
Calcium oxide,	3.38	0.82	2.50	
Sulphuric acid,	47.90	31.91	43.00	
Chlorine,	7.80	0.14	2.50	
Insoluble matter,	2.36	0.26	1.41	

German Potash Salts (11 Analyses).

Moisture at 100° C.,	25.83	.45	13.14	
Potassium oxide,	50.40	7.56	21.63	
Sodium oxide,	26.23	1.30	13.76	
Calcium oxide,	1.26	0.06	.85	
Magnesium oxide,	9.83	Trace.	9.25	
Sulphuric acid,	21.53	.17	10.85	
Chlorine,	49.11	22.27	35.63	
Insoluble matter,	3.76	.90	2.08	

Kainite (3 Analyses).

Moisture at 100° C.,	13.57	2.15	9.26	
Potassium oxide,	16.48	12.51	14.04	
Sodium oxide,	–	–	*21.38	* The only estimation made.
Calcium oxide,	1.41	.82	1.12	
Magnesium oxide,	11.30	6.65	8.97	
Sulphuric acid,	23.71	17.53	21.05	
Chlorine,	–	–	*32.38	* The only estimation made.
Insoluble matter,	1.56	.17	.86	

Carnallite (1 Analysis).

	Per cent.
Potassium oxide,	13.68
Sodium oxide,	7.66
Magnesium oxide,	13.19
Sulphuric acid,	.56
Chlorine,	41.56

Krugite (1 Analysis).

	Per cent.
Moisture at 100° C.,	4.82
Calcium oxide,	12.45
Magnesium oxide,	8.79
Potassium oxide,	8.42
Sodium oxide,	5.57
Sulphuric acid,	31.94
Chlorine,	6.63
Insoluble matter,	14.96

Sulphate of Magnesia (9 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	31.90	7.50	22.50	
Calcium oxide,	3.89	1.15	2.52	
Magnesium oxide,	*25.29	13.50	18.25	* Kieserite, natural and calcined.
Sulphuric acid,	*52.23	31.91	37.00	
Insoluble matter,	11.06	.40	5.73	

Nova Scotia Plaster (9 Analyses).

Moisture at 100° C.,	15.79	.52	6.50
Calcium oxide,	37.59	30.60	33.50
Magnesium oxide,	1.40	.36	.75
Sulphuric acid,	54.10	33.56	44.00
Carbonic acid,	–	–	–
Insoluble matter,	7.95	.45	2.00

Onondaga Plaster (7 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	22.25	8.95	13.27	
Calcium oxide,	31.46	29.15	30.00	Contains 1 sample of Cayuga Plaster.
Magnesium oxide,	6.06	3.89	4.66	
Sulphuric acid,	36.00	31.58	33.00	
Carbonic acid,	8.80	7.20	8.20	
Insoluble matter,	12.00	8.28	9.83	

Gypseous Shale (1 Analysis).

	Per cent.
Calcium sulphate,	38.55
Calcium carbonate,	11.05
Magnesium carbonate,	2.65
Insoluble matter,	37.15

Gas-house Lime (4 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	33.55	11.01	22.28	
Calcium oxide,	45.80	40.00	42.66	
Magnesium oxide,	8.30	8.30	8.30	
Sulphuric acid,	20.73	20.73	20.73	Sulphuric acid includes all forms of sulphur present.
Insoluble matter,	15.00	0.40	6.05	

Lime Waste.

	Per Cent.			Remarks.
	Liquid from Lime-vats (Evaporated).	Mass from bottom of Lime-vats.	Lime Waste from Sugar Factory.	
Moisture at 100° C., . .	11.50	17.54	36.30	
Ash, ...	41.00	65.24	–	
Calcium oxide, . . .	23.40	47.80	27.51	
Magnesium oxide, . .	–	–	Trace.	
Potassium oxide, . .	–	–	.22	
Phosphoric acid, . .	.77	.81	2.25	
Nitrogen, ...	6.87	1.06	–	
Insoluble matter, . .	.10	5.50	.32	

Lime-kiln Ashes (7 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., . .	30.70	.20	15.45	
Calcium oxide, . . .	50.16	36.00	43.08	
Magnesium oxide, . .	4.45	1.26	2.60	
Potassium oxide, . .	1.70	.02	.86	
Phosphoric acid, . .	3.16	Trace.	1.18	
Carbonic acid, . . .	39.36	9.66	16.66	
Insoluble matter, . .	53.77	3.30	14.54	

Marls (4 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	55.80	0.60	18.18	
Calcium oxide,	50.61	20.72	40.07	
Magnesium oxide,	1.03	0.22	0.64	Massachusetts.
Iron and alumina,	1.00	0.36	0.69	
Phosphoric acid,	2.72	0.07	1.05	
Carbonic acid,	40.38	16.63	28.51	
Insoluble matter,	3.44	3.44	3.44	

Virginia Marl.

	Per Cent.		Remarks.
	2 feet below Surface.	4 feet below Surface.	
Moisture at 100° C.,	16.70	15.26	
Calcium oxide,	9.21	5.29	No. 1 contained a large amount of shells.
Magnesium oxide,	0.25	0.16	
Potassium oxide,	0.61	0.37	
Phosphoric acid,	0.09	0.08	No. 2 was largely sand.
Sulphuric acid,	1.00	0.31	
Carbonic acid,	4.23	1.76	
Insoluble matter,	59.59	68.86	

Wood Ashes. (Canada.) (71 Analyses.)

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., . .	28.57	0.70	12.00	
Calcium oxide, . . .	50.89	18.00	34.44	
Magnesium oxide, . .	7.47	2.28	3.50	
Iron oxide, ...	–	–	0.83	
Potassium oxide, . .	8.51	2.49	5.50	
Phosphoric acid, . .	3.34	0.29	1.81	
Insoluble matter, . .	24.10	2.10	12.50	

Cotton-seed Hull Ashes (16 Analyses).

Moisture at 100° C., . .	26.81	2.30	7.33	
Calcium oxide, . . .	39.75	3.35	10.00	
Magnesium oxide, . .	17.15	2.02	9.50	
Iron oxide, ...	–	–	1.50	
Potassium oxide, . .	42.12	5.00	20.95	
Phosphoric acid, . .	13.67	0.76	7.52	
Insoluble matter, . .	32.48	5.38	11.79	

Ashes of Spent Tan-bark (3 Analyses).

Moisture at 100° C., . .	7.45	4.87	6.31	
Calcium oxide, . . .	37.26	31.35	33.46	
Magnesium oxide, . .	5.10	2.57	3.55	
Potassium oxide, . .	2.87	1.14	2.04	
Phosphoric acid, . .	2.77	0.13	1.61	
Insoluble matter, . .	24.33	24.33	24.33	

Ashes of Waste Products.

	Per Cent.			Remarks.
	Chestnut R. R. Ties.	Logwood.	Mill.	
Moisture at 100° C.,	6.15	1.50	0.53	
Calcium oxide,	4.71	3.90	34.93	
Magnesium oxide,	1.80	Trace.	1.35	
Potassium oxide,	0.19	0.08	1.60	
Phosphoric acid,	1.54	2.30	0.46	
Insoluble matter,	77.83	9.70	36.36	

Hard Pine Wood Ashes.

	Per cent.
Moisture at 100° C.,	0.75
Calcium oxide,	24.95
Magnesium oxide,	8.39
Potassium oxide,	10.16
Phosphoric acid,	2 24
Insoluble matter,	29.90

Nitrate of Potash (1 Analysis).

	Per cent.
Moisture at 100° C.,	1.75
Potassium oxide,	45.62
Nitrogen,	14.58
Insoluble matter,	Trace.

Nitrate of Soda (12 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	2.00	0.85	1.25	
Sodium oxide,	70.97	35.00	35.50	
Calcium oxide,	0.41	Trace.	Trace.	
Magnesium oxide,	0.04	Trace.	Trace.	
Nitrogen,	16.26	14.44	15.75	
Sulphuric acid,	0.20	Trace.	Trace.	
Chlorine,	2 52	0.20	0.50	
Insoluble matter,	0.90	0.24	0.50	

Saltpetre Waste from Gunpowder Works (6 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	4.24	0.50	2.75	
Potassium oxide,	30.94	4.65	18.00	
Sodium oxide,	45.92	22.08	34.00	
Calcium oxide,	*0.83	*0.71	0.75	* Only estimations.
Magnesium oxide,	*0.28	*0.09	0.19	
Nitrogen,	3.30	0.80	2.43	
Sulphuric acid,	*4.85	*0.84	2.85	* Only estimations.
Chlorine,	56.00	37.66	48.30	
Insoluble matter,	†	–	–	† Not reported.

Nitre Salt-cake (2 Analyses).

Moisture at 100° C.,	6.71	5.34	6.03	
Potassium oxide,	0.87	Trace.	0.87	
Sodium oxide,	32.72	26.40	29.56	
Nitrogen,	2.29	–	2.29	
Sulphuric acid,	48.85	46.69	47.77	
Insoluble matter,	4.12	3.73	3.92	

Sulphate of Ammonia (21 Analyses).

Moisture at 100° C.,	2.40	0.13	1.00	
Nitrogen,	22.23	19.70	20.50	
Sulphuric acid,	70.70	57.68	60.00	
Insoluble matter,	–	–	Trace.	

Ammonite.

	Per cent.
Moisture at 100° C.,	5.88
Phosphoric acid,	3.43
Nitrogen,	11.33
Insoluble matter,	1.38

Dried Blood (11 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	21.52	7.65	12.50	
Ash,	10.04	3.56	6.37	
Phosphoric acid,	6.23	1.53	1.91	
Nitrogen,	13.55	7.80	10.52	

Refuse Materials (Animal).

	Per Cent.			Remarks.
	Oleomargarine Refuse.	Felt Refuse.	Sponge Refuse.	
Moisture at 100° C.,	8.54	39.24	7.25	
Ash,	14.42	33.53	–	
Calcium oxide,	–	–	3.94	
Magnesium oxide,	–	–	1.27	
Phosphoric acid,	0.88	–	3.19	
Nitrogen,	12.12	5.26	2.43	
Insoluble matter,	0.96	8.44	39.05	

Horn and Hoof Waste (3 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	10.27	10.08	10.17	
Ash,	14.62	1.05	7.63	
Phosphoric acid,	2.30	2.30	2.30	
Nitrogen,	16.10	11.84	14.47	
Insoluble matter,	0.24	0.24	0.24	

Wool Waste (3 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., . .	10.12	8.43	9.27	*Saturated with oil.
Nitrogen, ...	*6.25	5.00	5.62	

Raw Wool and Wool Washings.

	Per Cent.			Remarks.
	Raw Wool.	Water Washings.	Acid Washings.	
Moisture at 100° C., . .	6.95	–	–	
Ash, ...	7.54	–	–	
Fat, ...	3.92	–	–	
Calcium oxide, . . .	–	0.28	0.61	
Magnesium oxide, . .	–	None.	0.20	
Potassium oxide, . .	–	3.92	4.20	
Sodium oxide, . . .	–	0.49	0.40	
Nitrogen, ...	12.88	–	–	
Insoluble matter, . .	3.63	–	–	

Meat Mass (6 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., .	18.75	8.16	12.09	
Ash, ...	14.66	2.90	13.60	
Total phosphoric acid, .	3.58	0.56	2.07	
Nitrogen, ...	11.50	9.69	10.44	
Insoluble matter, . .	0.77	0.40	0.58	

Refuse from Rendering Establishments.

	Per Cent.				
	Bone Soup.	Dried Soup from Meat and Bone.	Dried Soup from Rendering Cattle Feet.	Soup from Horse Rendering Factory.	Soap-Grease Refuse.
Moisture at 100° C.,	82.92	14.80	10.80	92.14	38.79
Ash,	7.07	8.40	7.50	–	43.13
Phosphoric acid,	1.26	0.53	0.46	0.14	11.04
Nitrogen,	1.14	9.97	14.47	1.12	2.21
Insoluble matter,	–	0.64	0.26	–	1.20

Bones (95 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	11.90	3.05	7.47	
Ash,	74.90	37.25	56.07	
Total phosphoric acid,	29.83	12.06	22.50	
Soluble phosphoric acid,	0.76	0.10	0.43	
Reverted phosphoric acid,	16.78	2.24	6.50	
Insoluble phosphoric acid,	23.37	8.13	15.70	
Nitrogen,	6.75	1.50	4.12	
Insoluble matter,	6.00	0.04	2.00	

Tankage (12 Analyses).

Moisture at 100 C.,	28.09	5 46	14.61	
Ash,	37.06	19.40	23.23	
Total phosphoric acid,	14.60	8.00	10.67	
Soluble phosphoric acid,	0.27	0.27	0.27	
Reverted phosphoric acid,	3.25	3.25	3.25	
Insoluble phosphoric acid,	8.79	8.79	8.79	
Nitrogen,	8.07	5.82	7.08	
Insoluble matter,	2.00	0.56	1.23	

Fish containing 20 per cent. or less of Moisture (42 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	19.88	6.61	13.24	
Ash,	72.23	15.99	20.00	
Total phosphoric acid,	16.64	4.33	8.25	
Soluble phosphoric acid,	1.70	.37	.55	
Reverted phosphoric acid,	4.57	1.78	2.17	
Insoluble phosphoric acid,	7.16	2.11	3.80	
Potassium oxide,	.45	.45	.45	
Nitrogen,	10.24	3.87	7.05	
Insoluble matter,	4.99	.74	2.50	

Fish containing between 20 per cent. and 40 per cent. of Moisture (8 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	38.11	20.58	29.34	
Ash,	36.50	16.87	24.14	
Total phosphoric acid,	8.90	5.60	7.25	
Soluble phosphoric acid,	*.82	.82	.82	* Fish Pomace.
Reverted phosphoric acid,	*2.87	2.87	2.87	* Fish Pomace.
Insoluble phosphoric acid,	*3.99	3.99	3.99	* Fish Pomace.
Potassium oxide,	†0.85	0.85	0.85	† Dry ground fish.
Nitrogen,	7.41	4.22	5.81	
Insoluble matter,	2.89	0.82	1.85	

Fish containing 40 per cent. and more of Moisture (10 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100 C., . .	50.58	40.35	45.46	
Ash, ...	20.78	1.92*	12.50	* Fish-liver refuse.
Total phosphoric acid, .	8.56	1.02*	5.08	
Soluble phosphoric acid, ,	1.51	0.83	1.17	
Reverted phosphoric acid,	2.02	0.64	1.33	
Insoluble phosphoric acid,	3.62	1.88	2.75	
Potassium oxide, . .	–	–	–	
Nitrogen, ...	7.60	2.43	4.97	
Insoluble matter, . .	2.44	0.16	1.35	

Whale Flesh.

	Per Cent.			Remarks.
	Raw.	Dry (with Fat).	Dry (without Fat).	
Moisture at 100° C., . .	44.50	–	–	
Ash, ...	1.04	1.86	3.20	
Fat, ...	22.81	40.70	–	
Flesh, ...	32.10	57.44	96.80	
Nitrogen, ...	4.86	8.68	14.60	

Lobster Shells.

	Per cent.
Moisture at 100° C., ...	7.27
Calcium oxide, ...	22.24
Magnesium oxide, ...	1.30
Phosphoric acid, ...	3.52
Nitrogen, ...	4.50
Insoluble matter, ...	0.27

Peruvian Guano (26 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	22.61	7.02	14.81	
Ash,	61.65	13.58	37.61	
Total phosphoric acid,	23.10	3.43	13.26	
Soluble phosphoric acid,	8.80	0.35	4.57	
Reverted phosphoric acid,	6.20	1.38	3.79	
Insoluble phosphoric acid,	16.50	4.67	10.58	
Potassium oxide,	4.08	1.14	2.61	
Nitrogen,	11.26	4.44	7.85	
Insoluble matter,	11.91	1.30	6.60	

Bat Guano (9 Analyses).

Moisture at 100° C.,	72.38	7.80	40.09	
Ash,	72.14	4.34	38.24	
Phosphoric acid,	6.53	1.00	3.76	One sample contained 1.31 per cent. potassium oxide.
Nitrogen as nitrates,	1.80	0.24	1.02	
Nitrogen as ammoniates,	3.42	1.49	2.45	
Nitrogen in organic matter,	5.66	0.34	3.00	
Insoluble matter,	54.15	0.20	2.00	

Cuba Guano (5 Analyses).

Moisture at 100° C.,	36.85	12.10	24.27	
Potassium oxide,	1.20	0.14	0.67	
Phosphoric acid,	24.35	11.54	17.94	
Nitrogen as nitrates,	1.00	0.24	0.62	
Nitrogen as ammoniates,	0.26	0.14	0.20	
Nitrogen in organic matter,	1.48	0.23	0.85	
Insoluble matter,	3.40	2.95	3.17	

Caribbean Guano (*Orchilla*) (10 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	12.50	2.12	7.31	
Calcium oxide,	45.00	34.91	39.95	
Magnesium oxide,	4.13	2.46	3.29	
Phosphoric acid,	35.43	18.11	26.77	
Sulphuric acid,	2.36	1.80	2.08	
Insoluble matter,	2.40	0.17	1.27	

South American Bone Ash.

	Per cent.
Moisture at 100° C.,	7.00
Calcium oxide,	44.89
Phosphoric acid,	35.89
Insoluble matter,	4.50

South Carolina Rock Phosphate (4 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	1.90	0.10	1.50	
Calcium oxide,	–	–	*41.87	* Only estimate.
Magnesium oxide,	–	–	*3.03	
Iron and alumina oxide,	–	–	*4.26	
Total phosphoric acid,	30.51	25.81	28.03	
Soluble phosphoric acid,	–	–	*0.27	* Only estimate.
Reverted phosphoric acid,	0.47	0.19	0.33	
Insoluble phosphoric acid,	30.31	25.07	27.69	
Insoluble matter,	13.74	9.18	11.61	

Navassa Phosphate (2 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	–	–	*5.60	* Only one test.
Calcium oxide,	37.67	37.22	37.44	
Iron oxide,	11.79	8.75	10.27	
Alumina oxide,	–	–	*4.24	* Only one test.
Phosphoric acid,	34.45	34.09	34.27	
Insoluble matter,	–	–	*2.70	* Only one test.

Brockville Phosphate (1 Analysis).

	Per cent.
Moisture at 100° C.,	2.50
Phosphoric acid,	35.21
Insoluble matter,	6.46

Bone-black (5 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	10.65	1.55	4.60	
Phosphoric acid,	30.54	23.47	28.28	
Insoluble matter,	6.60	1.53	3.64	

Phosphatic Slags.

	Per Cent.		Remarks.
	I.	II.	
Moisture at 100° C.,	0.10	0.37	
Calcium oxide,	41.87	49.82	
Magnesium oxide,	3.03	–	
Iron and alumina oxides,	4.26	–	I. German phosphatic slag.
Total phosphoric acid,	30.51	18.91	
Soluble phosphoric acid,	–	–	II. English slag.
Reverted phosphoric acid,	0.19	5.93	
Insoluble phosphoric acid,	30.32	12.98	
Insoluble matter,	13.74	5.06	

Castor Bean Pomace (3 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	10.18	9.25	9.98	
Calcium oxide,	0.96	0.77	0.87	
Magnesium oxide,	0.37	0.20	0.29	
Potassium oxide,	1.70	0.64	1.12	
Phosphoric acid,	2.22	2.03	2.16	
Nitrogen,	5.69	5.33	5.56	
Insoluble matter,	2.38	1.12	1.75	

Cotton Refuse.

	Per Cent.			Remarks.
	Cotton Dust.	Cotton Waste (Dry).	Cotton Waste (Wet).	
Moisture at 100° C.,	34.46	5.53	34.69	
Ash,	50.93	–	–	
Calcium oxide,	0.90	1.45	2.45	
Magnesium oxide,	0.90	0.87	1.13	
Potassium oxide,	0.19	0.89	0.80	
Phosphoric acid,	0.21	0.84	1.54	
Nitrogen,	0.50	1.32	1.30	
Insoluble matter,	47.46	49.68	41.33	

Cotton-seed Meal (5 Analyses).

	Per Cent.		Remarks.
	I.	II.	
Moisture at 100° C.,	6.80	9.90	
Ash,	5.77	–	I. Average of four Analyses.
Calcium oxide,	0.39	0.22	
Magnesium oxide,	0.99	0.56	II. Damaged.
Potassium oxide,	0.89	1.21	
Phosphoric acid,	1.45	1.26	
Nitrogen,	6.10	3.73	
Insoluble matter,	0.60	0.20	

Rotten Brewer's Grain.

	Per cent.
Moisture at 100° C.,	78.77
Calcium oxide,	.26
Magnesium oxide,	.15
Potassium oxide,	.04
Phosphoric acid,	.43
Nitrogen,	.72
Insoluble matter,	.59

Tobacco Stems (5 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C.,	12.18	8.95	10.61	
Ash,	15.00	13.30	14.07	
Calcium oxide,	4.76	3.39	3.89	
Magnesium oxide,	1.40	1.11	1.23	
Potassium oxide,	8.82	3.34	6.44	
Sodium oxide,	0.68	0.16	0.34	
Phosphoric acid,	0.87	0.44	0.60	
Nitrogen,	2.69	0.90	2.29	
Insoluble matter,	1.35	0.29	0.82	

Refuse Materials (Vegetable).

	Per Cent.			Remarks.
	Glucose Refuse.	Hop Refuse.	Sumac Waste.	
Moisture at 100 C.,	8.10	80.98	63.06	
Ash,	–	–	6.80	*Potassium oxide.*
Calcium oxide,	0.18	0.27	1.14	I. .15 per cent.
Magnesium oxide,	0.02	0.10	3.25	II. .11 per cent.
Phosphoric acid,	0.29	0.20	–	III. .17 per cent.
Nitrogen,	2.62	0.98	1.19	
Insoluble matter,	0.07	0.63	2.25	

Sea-weeds.

	PER CENT.					Remarks.
	Eel-Grass.		Rockweed.		Wet Kelp.	
	I.	II.	Green.	Dry.		
Moisture at 100° C.,	45.61	25.17	68.50	10.68	88.04	
Ash,	20.39	10.81	23.70	55.75	2.26	
Calcium oxide,	1.56	2.70	–	7.66	–	
Magnesium oxide,	0.09	0.12	–	0.21	–	
Potassium oxide,	1.61	0.21	–	4.89	–	
Sodium oxide,	2.51	0.74	–	7.90	–	
Phosphoric acid,	0.41	0.22	–	2.75	–	
Nitrogen,	0.70	0.96	0.62	1.45	0.26	
Insoluble matter,	0.46	1.66	–	10.40	–	

Sea-weed Ashes.

	Per cent
Moisture at 100° C.,	1.47
Calcium oxide,	6.06
Magnesium oxide,	4.37
Potassium oxide,	.92
Sodium oxide,	8.76
Phosphoric acid,	.30
Sulphuric acid,	2.98
Sulphur,	.14
Chlorine,	6.60
Magnesium chloride,	.14
Insoluble matter,	63.65

Rockweed.

[I. Collected in May. II. Collected in December.

	Per Cent.	
	I.	II.
Fresh wet rockweed lost, in air, of water,	78.700	65.920
Fresh wet rockweed lost, at 100° C., of water,	90.400	76.920
Air-dried rockweed contained, of vegetable matter,	88.220	89.000
Air-dried rockweed contained, of water,	11.780	11.000
The filled pods left, at 100° C., of solid organic matter,	7.360	–
The fresh stems left, at 100° C., of solid organic matter,	30.650	–
The slime of the pods, dried at 100° C., contained, of nitrogen,	2.920	–
Rockweed, entire plant with filled pods, dried at 100° C., contained, of nitrogen,	2.286	1.721
Rockweed, air-dried, contained, of nitrogen,	2.017	1.432
" fresh (wet), contained, of nitrogen,	.487	.397
" dried at 100° C., contained, ashes,	28.930	24.890
" air-dried, contained, ashes,	6.220	22.150
" fresh (wet), contained, ashes,	3.770	5.825
The slime of the pods contained, ashes,	49.356	–

One hundred parts of the ash contained (I.) : —

	Per cent.
Potassium oxide,	4.842
Sodium oxide,	12.050
Calcium oxide,	2.691
Magnesium oxide,	2.753
Ferric oxide,	.338
Sulphuric acid,	7.986
Phosphoric acid,	6.240

Mud.

	Per Cent.						Remarks.
	Mussel Mud.	Mussel Mud.	Salt Mud.	Salt Mud.	Black Mud.	Fresh-Water Mud.	
Moisture at 100° C.,	60.01	2.24	46.36	60.37	56.55	40.37	
Ash,	27.29	72.02	49.28	33.09	39.60	–	
Calcium oxide,	0.93	23.39	0.90	0.91	0.91	1.27	
Magnesium oxide,	0.14	–	0.31	0.43	0.66	0.29	
Potassium oxide,	6.17	–	0.33	0.32	0.38	0.22	
Sodium oxide,	0.70	–	0.94	0.94	0.86	–	
Ferric oxide,	3.48	8.26	4.55	3.70	4.26	1.80	
Phosphoric acid,	0.10	0.35	Trace.	Trace.	Trace.	0.26	
Nitrogen,	0.21	0.72	0.39	0.40	1.64	1.37	
Insoluble matter,	–	37.60	43.55	26.20	31.84	18.26	

Soil from a Diked Marsh.

	Per cent.
Moisture at 100° C.,	33.40
Ash,	7.85
Calcium oxide,	1.24
Potassium oxide,	.26
Phosphoric acid,	.13
Nitrogen,	1.64
Insoluble matter,	3.65

Muck (5 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., . .	89.89	12.03	55.13	
Ash, ...	26.12	3.05	13.75	
Nitrogen, ...	1.47	0.26	0.91	

Peat (8 Analyses).

	Per Cent.			Remarks.
	Highest.	Lowest.	Average.	
Moisture at 100° C., .	85.38	*11.29	61.50	* German Peat Mass.
Ash, ...	33.72	1.20	7.71	
Calcium oxide, . .	0.50	0.50	0.50	
Nitrogen, ...	1.40	0.41	0.71	
Insoluble matter, . .	0.38	0.38	0.38	

Turf (2 Analyses).

	Per Cent.		Remarks.
	I.	II.	
Moisture at 100 C., . . .	25.58	13.00	
Ash, ...	3.28	9.43	
Nitrogen, ...	1.91	1.97	

Hen Manure.

	Per Cent.		Remarks.
	Dried.	Fresh.	
Moisture at 100 C.,	8.35	45.73	
Calcium oxide,	2.22	0.97	
Magnesium oxide,	0.62	–	
Potassium oxide,	9.94	0.18	
Phosphoric acid,	2.02	0.47	
Nitrogen in organic matter,	1.85	0.79	
Nitrogen as ammoniates,	0.28		
Insoluble matter,	34.65	39.32	

Poudrette.

	Per cent.
Moisture at 100° C.,	5.25
Ash,	35.45
Potassium oxide,	0.49
Phosphoric acid,	5.74
Nitrogen,	3.58
Insoluble matter,	4.65

Miscellaneous.

	Per Cent.	
	Soot.	Ashes from Blue Works.
Moisture at 100 C.,	5.54	12.74
Organic and volatile matter,	22.90	36.22
Magnesium oxide,	–	Trace.
Potassium oxide,	1.83	9.02
Cyanogen compounds,	–	Trace.
Insoluble matter,	35.34	12.30

METEOROLOGY.

The past year's meteorological observations have been a continuation of those of the two previous seasons, being on the same general plan as recommended to voluntary observers of the U. S. Signal Service, and described in the Third Annual Report. As soon as possible after the close of each month, a copy of our monthly records of observations is forwarded to the chief signal officer at Washington, D. C., and also to the officer stationed at Boston, Mass. A summary of each month's observations are published in our bulletins and annual reports, and are thus made accessible to the farmers throughout the State.

January opened with 3.50 inches of snow, and good sleighing. Between the 5th and 17th, 29 inches of snow fell, but during the thaw of the last eight days the snow nearly all disappeared, and at the end of the month only a little here and there was to be seen. The mean temperature of the month was 3.9° below that of any month of January for the last fifty years. Storms were frequent, and 22.50 inches of snow fell during February. During the evening of Feb. 18 there was a sharp shower, accompanied by thunder and lightning, and at 8 P. M. a slight earthquake shock was felt. Bluebirds were seen on the 13th, and robins on the 20th, of March. The temperature for the month of April was lower than for any previous April since 1875, and on the 18th there was a fall of 6.50 inches of snow. On April 8 the first frost occurred; the last, on May 14. Abundance of moisture characterized the growing months — June, July and August. The total rainfall for June was 5.09 inches; for July, 8.93 inches; and for August, 7.75 inches. The mean

temperature for July (73.70°) was the highest for the same month since 1839, when it was 74.40°; July, 1863, it was 70.87°, the nearest approach to it. Similar relations are true of the total rainfall. During the month there fell 8.93 inches, the largest amount during any month of July since 1839, when it was 9.56 inches; in 1863 it was 8.63 inches, the next highest amount. Between 4.30 P. M. on the 23d of July, and 6 A. M. on the 24th, 3.50 inches of rain fell; and from 1 P. M. on the 24th, to 4.25 P. M. of the same day, 1.50 inches fell, making a total rainfall of 5.00 inches inside of 24 hours. It was the heaviest rainfall of the season, and did a large amount of damage, not only to the growing crops, but by the washing of roads and hillsides. Very heavy fogs characterized both August and September. The first frost occurred on the 17th of September. Nov. 11 there were several snow-squalls during the day, but the first snow of the season of any amount was on the 18th of December. The year closes with about four inches of snow, and good sleighing.

During the summer there have been sixteen thunderstorms, some of which were very severe, and did considerable damage. The first occurred on the 18th of February, and the last on the 2d of October. During those storms which occurred in the months of July and August, observations were taken every half-hour, and forwarded to the signal service officer at Boston, Mass.

Weekly crop reports were forwarded during the months of July, August and September, to the Boston Signal Service Station, giving the rainfall, temperature, amount of sunshine, and the condition of the different crops. Farmers had good weather for securing their hay crop, but, on account of the excessive moisture of July and August, they were seriously hindered with their rowen, some of it being spoiled before an opportunity came to secure it. Potatoes suffered from the continued wet spell, but a good crop of corn was obtained. The open fall was favorable for farm work.

The prevailing direction of the wind for the year was N.W. It was northwest in January, February, March, April, August, September, October, November and December; southwest in May and June, and south in July.

The number of days when the sky was less than four-tenths covered by clouds ("clear" days), was seventy-one; the greatest number, twelve, being in May, and the fewest, two, in October.

There were ninety-five "cloudy" days, or those when the sky was more than seven-tenths covered by clouds. December had the greatest number, sixteen; while April and May had the fewest, four each.

Of the remaining 199 days, only two of them appear as "fair" days, that is, between four-tenths and seven-tenths cloudy; the others were variable, being fair or cloudy one portion, and clear or fair another.

The highest temperature of the year was 93.6°, occurring on July 2; the lowest was on the 19th of January, — 22.2°. The maximum is 2° lower than that of last season (1886), which was 95° on the 6th of July; while the minimum is practically the same, last year (1886) being — 22.° on the 13th and 14th of January. The absolute range of temperature for 1887 is 115.2°; 1.8° lower than that of the season of 1886.

Summary of Meteorological Observations, 1887.

	Temperature. Degrees Fahrenheit.											Relative Humidity. Per ct.				Precipitation. Inches.	
	7 A. M.	2 P. M.	9 P. M.	Mean.	Maximum.	Minimum.	Range.	Absolute Maximum.	Date.	Absolute Minimum.	Date.	7 A. M.	2 P. M.	9 P. M.	Mean.	Depth of Water.	Date of Greatest Fall.
January,	15.7	23.5	19.2	19.4	28.6	7.6	21.0	47.2	24th	—22.2	19th	–	–	–	–	4.57	29th
February,	20.3	27.8	24.3	24.2	32.1	15.7	16.4	43.8	9th	—3.8	5th	–	–	–	–	5.05	26th to 27th
March,	22.0	33.0	27.2	26.4	33.6	17.1	16.5	46.0	21st	—2.4	5th	–	–	–	–	4.05	5th to 6th
April,	36.3	49.1	40.6	41.6	51.6	30.4	21.2	74.4	10th	17.1	8th	–	–	–	–	2.97½	28th to 29th
May,	54.5	70.8	58.6	60.9	73.1	47 3	25.8	86.5	20th	33.2	14th	83.0	54.4	72.9	70.7	1.13	28th
June,	60.7	73 9	66.0	65.7	76.0	53.4	22 6	91.0	30th	38 5	11th	85.0	58.5	82.2	76.4	5.09	22d to 24th
July,	70.0	81.5	71.7	73.7	83.7	64.0	19.7	93 6	2d	56.0	15th	89.7	64.9	85.6	80.1	8.93	23d to 24th
August,	54.4	73.4	63.0	64.9	75 4	54.1	21.3	88.0	1st	42.5	14th, 28th	92.1	66.8	84.9	81.2	7.75	18th
September,	50.1	65.5	54.4	55.9	67.1	45.0	22.1	80.0	7th	29.5	27th	90.3	63.8	87.4	80.5	1.22	7th
October,	41.1	56.0	46.3	47.0	58.8	36.6	22.2	74.4	8th	17.0	30th	88.9	55.9	79.4	74.7	2.10	21st
November,	32 0	43.5	35.1	36 5	45.7	26 8	18.9	64.8	7th	11.0	30th	–	–	–	–	3.35	15th
December,	26.7	31.5	25.8	26.6	34.0	17.3	16.7	51.0	12th	—6.0	31st	–	–	–	–	4.11	28th
Sums and Means,	40.31	52.45	44.35	45.2	54.97	34.60	20.36	70 05	–	17.53	–	88.16	60.72	82 06	77.26	50.33	–

Miscellaneous Phenomena. — Dates.

	Frost.	Snow.	Rain.	Thunder-storms.	Solar Halos.	Lunar Halos.
January,	4.	5, 6, 9, 10, 13, 14, 15, 17, 19, 23, 24, 26, 30, 31.	1, 23, 24, 29, 30, 31.	–	7, 8.	4, 6, 7, 8, 11.
February,	–	2, 3, 6, 7, 8, 9, 14, 15, 18, 22, 24, 26, 27.	8, 10, 11, 14, 15, 18, 24.	18.	–	1, 4.
March,	–	5, 14, 15, 17, 22.	6, 9, 10, 18, 19, 22, 28, 29.	–	5.	2.
April,	8, 9, 15, 21.	18.	5, 16, 23, 25, 26, 28, 29.	29.	–	1, 2.
May,	14.	–	6, 25, 26, 28.	6, 25, 27.	–	2, 3.
June,	–	–	1, 2, 4, 17, 21, 22, 24.	22, 23.	–	–
July,	–	–	5, 6, 10, 16, 17, 18, 21, 23, 24, 26, 29.	23, 24, 29.	–	–
August,	–	–	1, 2, 3, 11, 18, 20, 22, 23, 24, 28, 30.	11, 18, 20, 24.	–	–
September,	17, 18, 27.	–	7, 12, 22, 29, 30.	7.	–	–
October,	12, 14, 15, 16, 17, 20, 23, 26, 29.	–	1, 2, 4, 11, 21.	2.	–	–
November,	2, 3-5, 6, 9, 10, 11, 18, 19, 22, 29.	11.	10, 11, 15, 19, 20, 23, 25, 26, 28.	–	–	–
December,	1, 2, 4, 6, 7, 9, 14.	3, 15, 17, 18, 21, 26, 31.	5, 10, 11, 12, 15.	–	–	–

Record

Of the Average Temperature taken from Weather Records at Amherst, Mass., for three consecutive months, during the summer and winter, beginning with the year 1836.

December, January, February.		June, July, August.	
1836–37, . .	25.396° F.	1837, . . .	69.130° F.
1837–38, . .	26.386°	1838, . . .	69.550°
1838–39, . .	25.950°	1839, . . .	70.180°
1839–40, . .	20.626°	1840, . . .	68.770°
1840–41, . .	23.146°	1841, . . .	69.230°
1841–42, . .	28.516°	1842, . . .	68.210°
1842–43, . .	23.460°	1843, . . .	67.950°
1843–44, . .	21.320°	1844, . . .	67.260°
1844–45, . .	25.550°	1845, . . .	70.120°
1845–46, . .	22.140°	1846, . . .	68.406°
1846–47, . .	25.176°	1847, . . .	68.806°
1847–48, . .	28.966°	1848, . . .	69.210°
1848–49, . .	23.026°	1849, . . .	69.210°
1849–50, . .	27.570°	1850, . . .	68.820°
1850–51, . .	25.040°	1851, . . .	66.640°
1851–52, . .	21.620°	1852, . . .	66.830°
1852–53, . .	27.940°	1853, . . .	67.846°
1853–54, . .	23.670°	1854, . . .	69.856°
1854–55, . .	23.126°	1855, . . .	67.146°
1855–56, . .	20.820°	1856, . . .	69.225°
1856–57, . .	22.720°	1857, . . .	67.240°
1857–58, . .	26.956°	1858, . . .	67.930°
1858–59, . .	24.746°	1859, . . .	65.650°
1859–60, . .	24.790°	1860, . . .	66.540°
1860–61, . .	24.510°	1861, . . .	66.870°
1861–62, . .	24.470°	1862, . . .	66.490°
1862–63, . .	27.640°	1863, . . .	66.656°
1863–64, . .	26.060°	1864, . . .	69.336°
1864–65, . .	21.310°	1865, . . .	68.946°
1865–66, . .	25.676°	1866, . . .	67.400°
1866–67, . .	25.276°	1867, . . .	67.920°

Record of Temperature, etc. — Concluded.

December, January, February.		June, July, August.	
1867–68, . .	20.350° F.	1868, . . .	69.700° F.
1868–69, . .	26.290°	1869, . . .	66.890°
1869–70, . .	27.866°	1870, . . .	71.700°
1870–71, . .	26.666°	1871, . . .	67.810°
1871–72, . .	24.630°	1872, . . .	70.790°
1872–73, . .	21.350°	1873, . . .	68.596°
1873–74, . .	27.286°	1874, . . .	66.306°
1874–75, . .	21.180°	1875, . . .	68.026°
1875–76, . .	28.156°	1876, . . .	71.780°
1876–77, . .	23.510°	1877, . . .	70.080°
1877–78, . .	28.506°	1878, . . .	68.896°
1878–79, . .	24.290°	1879, . . .	68.150°
1879–80, . .	30.506°	1880, . . .	69.286°
1880–81, . .	21.856°	1881, . . .	67.966°
1881–82, . .	29.256°	1882, . . .	69.866°
1882–83, . .	24.220°	1883, . . .	68.840°
1883–84, . .	26.506°	1884, . . .	68.960°
1884–85, . .	22.630°	1885, . . .	66.740°
1885–86, . .	24.846°	1886, . . .	66.100°
1886–87, . .	22.146°	1887, . . .	68.100°

Summary

Of Average Temperature from 1836 to 1862 (25 years).

December, January, February.	June, July, August.
24.53 F.	68.26° F.

Summary

Of Average Temperature from 1862 to 1887 (25 years).

December, January, February.	June, July, August.
25.21° F.	68.53° F.

RECORD

OF THE

MAXIMUM AND MINIMUM TEMPERATURE, AND OF THE RAIN-FALL,

From 1836 to 1887, inclusive.

[The abstract, previous to the year 1883, has been obtained, through the courtesy of Miss S. C. Snell, from the observations of the late Prof. E. S. Snell of Amherst College. The remainder has been taken from those at the Experiment Station.]

MONTHS.	1836.						1837.						1838.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January,	–	–	–	–	–	4.21	20.26	42.00	31st	2.25	4th, 5th	1.75	31.99	46.00	18th	6.50	31st	2.45
February,	–	–	–	–	–	3.83	26.69	39.75	16th	7.50	13th	2.42	19.55	35 50	9th	9.50	17th	1.67
March,	32.68	48.50	28th	17.75	12th	3.13	33.70	48 00	24th	11.75	2d	2.65	36.35	47.00	24th	17.50	2d	1.69
April,	47.27	59.25	28th	32.75	12th	1.98	47.42	65.25	29th	36.00	1st	4.33	40.72	55.00	29th	31.50	15th, 17th	2.02
May,	61.36	76.25	3d	45.50	27th	2.59	57.88	72.00	31st	38.50	1st	5.76	54.32	70.50	22d	41.50	4th	3.63
June,	66.37	77 50	9th	51.75	21st	3.45	68.15	77.00	30th	34.00	17th	4.49	68.63	78.00	12th	57.00	3d	4.90
July,	73.62	83.75	8th	65.50	8th	6.02	70.64	82.50	1st	65.50	30th	7.35	71.86	81.50	10th	61.00	23d	2.27
August,	68.00	78.00	1st	57.00	11th	0.96	68.61	79.25	2d	59.50	23d	2.57	68.16	78.00	25th	56.50	27th	3.95
September,	62.36	77.75	20th	45.50	29th	2.28	61.42	75.00	19th	53.00	30th	1.07	62.73	72.50	8th	50.00	24th	6.38
October,	47.88	67.50	2d	32.75	26th	3.02	49.97	61.25	24th	34.50	29th	2.06	46.53	64.50	3d	34.00	30th	4.12
November,	38.22	60.00	12th	22.50	26th	3.49	40.23	62.50	21st	17.25	26th	1.90	34.07	53.00	5th	11.50	25th	5.77
December,	29.24	44.25	21st	7.75	30th	5.80	27.62	48.00	31st	6.00	22d	2.35	23.52	37.50	15th	5.50	31st	0.96
Means and Sums,	52.70	–	–	–	–	40.76	47.72	–	–	–	–	38.70	46.52	–	–	–	–	39.81

MONTHS.	1839.						1840.						1841.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	24.56	42.00	12th	1.50	1st	1.66	14.45	38.00	30th	—21.00	17th	3.15	25 63	50.00	8th, 9th	—17.00	5th	5.80
February, . .	29.79	39 00	27th	11.50	6th, 7th	1.75	28.50	56.00	23d	—14.00	5th	2.03	20.20	44.00	21st	—6.00	12th	1.50
March, . . .	37.54	50.50	27th	13.50	4th	1.69	34.97	64.00	4th	7.00	8th	3.18	31.90	60.00	26th	8.00	5th	2.85
April, . . .	52.18	60.50	28th	33.00	14th	4.14	48.95	79.00	23d	19.00	9th	3.98	41.63	67.00	28th	21.00	11th	4.52
May, . . .	60.71	67.50	28th	42.50	8th	3.49	57.06	88.00	28th	34.00	11th	1.91	54.39	81.00	24th	29.00	4th	3.47
June, . . .	65.40	71.50	21st	52.00	1st, 13th	3.30	65.50	88.00	29th, 30th	44.00	2d	4.60	68.35	90.00	30th	43.00	4th	1.65
July, . . .	74.40	77.00	20th	63.00	13th	9.56	70.56	94.00	17th	50.00	2d	3.34	69.53	94.00	23d	42.00	12th	2.55
August, . .	70.74	77.50	27th	53.50	29th	2.51	70.26	90.00	20th	50.00	10th, 16th	6.82	69.82	88.00	2d, 3d, 4th, 5th,	42.00	25th	3.18
September, . .	63.50	70.00	5th, 7th	43.50	29th	2.82	57.22	77.00	8th, 9th	36.00	15th, 14th	5.20	61.21	84.00	4th	46.00	27th	3.50
October, . .	53.32	61.50	19th	32.00	21st	1.78	47.39	72.00	6th	23.00	17th	5.04	42.81	64.00	30th, 31st	20.00	28th	3.73
November, . .	36.65	48.00	15th	23.00	22d, 23d	3.04	36.95	55.00	30th	18.00	21st	4.61	35.28	68.00	1st	13.00	30th	2.80
December, . .	28.93	46.00	5th	9.00	20th	7.09	23.61	44.00	10th	—2.00	25th	3.15	29.50	44.00	24th	5.00	23d	6.08
Means and Sums, .	49.81	–	–	–	–	42.83	46.28	–	–	–	–	47.01	48.85	–	–	–	–	41.63

MONTHS.	1842.						1843.						1844.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January,	25.55	37.00	31st	—10.00	6th	1 02	29.73	50.00	8th, 31st	—8.00	2d	1.99	13.93	39.00	13th	—22.00	28th	3.44
February,	30.50	55.00	4th	5.00	9th	3.73	16.48	37.00	11th	—15.00	17th	3.49	22.07	49.00	21st	—10.00	1st	2.18
March,	37.60	63.00	4th	13.00	12th	2.39	24.52	42 00	28th	7.00	19th	5.73	35.53	56.00	25th	5.00	5th	4.12
April,	46.50	82.00	22d	17.00	1st	2.92	44.63	70.00	22d	15.00	4th	4.82	51.95	83.00	14th	14.00	1st	0.57
May,	52.71	78.00	19th	30.00	21st	2.40	55.95	82.00	15th	35.00	3d, 4th	2.09	57.85	84.00	25th	33.00	22d	5.59
June,	64.10	84.00	19th	34.00	7th, 12th	3.18	65.28	86.00	27th	34.00	1st, 2d	5.18	65.55	86.00	27th	42.00	4th	3.00
July,	71.48	90.00	30th	49.00	22d	1.95	68.76	91.00	2d	47.00	6th	2.53	68.23	86.00	14th	40.00	5th	3.81
August,	69.05	82.00	18th, 26th	45.00	31st	7.42	69.81	84.00	31st	53.00	1st, 2d	9.38	68.00	84.00	17th	46.00	13th	4.93
September,	57.43	84.00	12th	30.00	24th	3.23	61.70	87.00	4th, 5th	30.00	28th	1.57	59.55	83 00	10th	26.00	28th	1.84
October,	47.44	70.00	9th	26.00	28th	2.84	44.93	69.00	21st	28.00	24th	9.45	47.55	70.00	10th	25.00	21st	6.49
November,	35.10	60.00	6th	13.00	29th	3.73	33.98	57.00	18th, 24th	17.00	15th	3.07	35.73	54.00	2d, 8th	3.00	30th	2.12
December,	24.18	43.00	5th	—2.00	24th	3.19	27 98	40.00	21st, 22d	2.00	14th	2.28	27.28	45.00	26th	—5.00	29th	2.49
Means and Sums,	46.81	–	–	–	–	38.05	45.32	–	–	–	–	51.58	45.94	–	–	–	–	40.58

MONTHS.	1845.						1846.						1847.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	24.52	46.00	25th	0°	19th	4.97	24.75	45.00	2d	−1.00	19th	2.74	25.50	44.00	5th, 6th	4.00	22d	4.86
February, . .	24.86	55.00	25th	−3.00	3d	3.37	20.14	40.00	5th	−6.00	19th	2.55	24.71	47.00	3d	−8.00	24th	4.88
March, . . .	36.93	71.00	30th	8.00	12th	3.56	36.33	59.00	29th	2.00	3d	4.35	29.24	52.00	25th	9.00	14th, 16th	3.57
April, . . .	45.59	77 00	24th	24.00	6th	1.70	50.06	76.00	18th	22.00	16th	1.54	43.28	77.00	22d	5.00	1st	1.41
May, . . .	56.15	88.00	12th	30.00	10th, 31st	2.42	58.29	83.00	26th	32.00	20th	4.33	57.48	84.00	29th	34.00	1st	1.91
June, . . .	66.71	90.00	8th	41.00	7th, 18th	2.57	61.96	87.00	18th	41.00	13th	3.10	64.73	88.00	28th	42.00	13th	4.44
July, . . .	72.12	94.00	14th	46.00	25th	3.31	70.66	93.00	11th	44.00	16th	3.25	72.42	91.00	19th	46.00	29th	4.48
August, . .	71.54	89.00	10th	42.00	29th	2 79	69.60	90.00	5th	47.00	19th	2.44	69.27	85.00	11th, 17th	48.00	20th	4.06
September, . .	58.30	81.00	4th	32.00	13th, 23d	2.58	65.48	83.00	6th	37.00	27th	0.47	59.30	85.00	4th	35.00	17th	3.63
October, . .	49.64	74.00	12th	17.00	22d	4.66	47.59	81.00	9th	25.00	26th	2.09	45.97	67.00	6th	15.00	27th	3.99
November, . .	41.49	65.00	4th	12.00	29th	3.90	43.05	61.00	8th	20.00	26th	4.96	43.15	70.00	4th	5.00	30th	4.17
December, . .	21.53	38.00	15th	−10.00	13th	3.91	25.32	45.00	28th	1.00	16th	3.10	34.24	59.00	11th	3.00	27th	6.41
Means and Sums, .	47.45	–	–	–	–	39.74	48.02	–	–	–	–	34.92	47.44	–	–	–	–	47.81

MONTHS.	1848.						1849.						1850.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	28.95	56.00	1st	—12.00	11th	2.92	20.02	46.00	26th	—8.00	11th	0.99	25.90	45.00	27th	—2.00	31st	4.75
February, . .	23.71	43.00	22d	—2.00	11th	2.60	18.50	43.00	24th	—10.00	16th	0.99	28.42	52.00	26th	—11.00	6th	3.56
March, . . .	32.03	64.00	31st	4.00	15th	3.03	35.57	60.00	31st	12.00	5th	4.21	32.43	60.00	14th	8.00	4th	1.86
April, . . .	43.32	74.00	22d	25.00	3d	1.55	43.40	63.00	4th	21.00	15th	2.24	42.91	70.00	26th, 28th	19.00	11th	3.93
May, . . .	59.47	86.00	18th	32.00	1st	6.18	53.42	83.00	21st	32.00	3d	3.61	53 38	73.00	13th	31.00	12th	8 72
June, . . .	67 62	90.00	17th	39.00	2d	2.58	66.88	92.00	22d	39.00	9th	1.53	67.27	90.00	20th	44.00	12th	2.88
July, . . .	69.45	87.00	22d	49.00	16th, 17th	4.72	72.09	93.00	13th	45.00	3d	2.25	72.08	87.00	30th	48.00	27th	6.81
August, . .	70.56	87.00	17th	44.00	26th	1.53	68.85	83.00	4th	50.00	16th	7.86	67.10	87.00	6th	44.00	18th, 28th	6.50
September, . .	57.43	81.00	11th	31.00	28th	2.49	60.05	70.00	17th	37.00	3d	1.40	59.40	80.00	1st, 6th	32.00	30th	4.93
October, . .	47.31	70.00	1st, 17th	28.00	9th, 11th, and 28th	3.15	47.03	68.00	17th	29.00	15th	6.36	48.18	67.00	5th	23.00	30th	3.65
November, . .	33.49	52.00	4th	11.00	11th	3.09	44.03	63.00	4th	25.00	1st, 2d and 16th	3.65	39.95	63.00	4th	16.00	23d	2.63
December, . .	30.56	58.00	19th	—3.00	24th	5.51	28.40	43.00	20th	3.00	26th	3.36	23.45	49.00	1st	—15.00	31st	5.37
Means and Sums,	47.04	–	–	–	–	39.38	46.52	–	–	–	–	38.45	46.71	–	–	–	–	55.50

MONTHS.	1851.						1852.						1853.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	23.79	48.00	26th	—5.00	5th, 8th	1.66	19.57	43.20	29th	—15.00	22d	2.42	24.26	45.00	11th	—2.50	27th	2.11
February, . .	27.89	48.00	22d	—8.00	1st	5.08	25.17	47.40	11th	—3.40	20th	3.35	26.72	51.00	6th	0.50	15th	6.69
March, . . .	35.51	73.00	31st	12.00	14th	1.23	30.86	53.00	13th	0.30	3d	3.26	33.82	56.40	30th	7.60	15th	2.39
April, . . .	46.20	67.00	24th	24.00	13th	4.43	39.44	61.00	30th	23.30	4th	4.71	44.02	76.30	29th	27.40	11th	3.79
May, . . .	55.61	82.00	13th	30.00	3d	4.07	56.05	79.00	6th	38.50	5th	2.30	56.70	84.20	26th	31.80	2d	5.40
June, . . .	63.60	88.00	30th	41.00	17th	3.69	65.38	84.00	17th	43.90	12th	2.54	66.97	91.30	21st	39.00	1st	2.64
July, . . .	69.13	87.00	17th	49.00	3d	4.31	69.95	90.00	9th, 22d	55.00	19th	3.38	68.73	85.10	9th	54.00	14th	3.59
August, . .	66.20	83.00	13th	39.00	27th	3.03	65.16	85.70	19th	48.90	4th	5.19	67.84	91.70	14th	45.90	29th	7.13
September, . .	60.93	80.00	12th	29.00	25th	2.05	58.37	85.00	3d	33.00	30th	2.48	59.54	84.70	5th	37.00	12th	5.66
October, . .	51.04	73.00	8th, 9th	31.00	17th	5.43	49.31	70.00	2d	24.30	27th	1.76	46.84	69.00	21st	24.90	30th	3.75
November, . .	34.54	56.00	2d	13.00	12th	5.30	36.42	50.80	3d	15.00	24th	6.43	39.14	59.50	19th	13.80	25th	6.24
December, . .	20.13	44.00	29th	—15.00	27th	3.17	32.85	56.00	7th	6.10	22d	4.88	26.31	42.80	10th	7.20	30th	1.84
Means and Sums,	46.21	–	–	–	–	43.50	45.71	–	–	–	–	42.72	46.65	–	–	–	–	51.23

MONTHS.	1854.						1855.						1856.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	22.75	50.41	12th	—9.60	29th	2.01	27.26	48.00	29th	10.70	11th	5.06	15.24	34.80	17th	—7.50	10th	2.48
February, . .	21.96	45.00	2d	—4.80	5th	4.53	19.83	42.00	15th	—16.00	7th	2.70	19.02	38.60	23d	—11.00	14th	0.79
March, . . .	31.62	65.49	16th	14.60	21st	3.11	31.53	57.80	31st	7.80	1st	1.08	25.88	44.90	24th	—9.00	10th	1.12
April, . . .	43.47	70.60	27th	23.70	3d	8.33	43.83	76.00	25th	17.00	2d	3.85	46.44	76.70	28th	16.50	1st	2.51
May, . . .	59.49	79.00	15th, 16th and 18th	34.00	7th	3.19	56.65	81.00	16th	41.50	9th	1.49	53.58	89.00	24th	38.20	4th	5.31
June, . . .	66.67	87.50	19th	39.80	1st	1.75	65.04	92.00	30th	48.00	12th	5.19	68.56	94.00	29th	48.00	1st	1.92
July, . . .	74.08	97.00	29th	57.70	14th	3.53	70.87	91.60	21st	57.20	19th	6.10	72.93	95.00	18th	55.90	2d	1.96
August, . .	68.82	88.50	13th, 22d	50.80	29th	0.99	65.53	84.50	4th	44.70	31st	2.55	66.19	87.30	1st	48.20	26th	12.13
September, . .	61.59	90.00	6th	33.80	30th	5.46	60.82	85.00	12th	33.00	20th	0.55	60.79	78.90	9th	41.80	25th	3.47
October, . .	51.53	75.80	9th	27.00	29th	2.31	49.73	73.00	5th	30.20	31st	10.03	48.63	75.50	11th	25.00	25th	1.40
November, . .	40.27	63.00	6th	14.00	1st	7.48	38.84	63.00	16th	15.00	23d	4.12	37.47	61.00	4th	18.00	21st	2.85
December, . .	22.20	41.50	26th	—9.00	23d	2.39	23.21	46.20	1st, 2d	7.00	31st	5.41	23.20	41.80	12th	—7.00	19th	4.19
Means and Sums,	46.99	–	–	–	–	–	46.52	–	–	–	–	48.38	44.84	–	–	–	–	40.13

MONTHS.	1857.						1858.						1859.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	13.54	37.10	27th	—18.20	24th	3.55	28.81	51.40	25th	0	2d	3.52	22.94	39.40	26th	—19.40	11th	4.89
February, . .	31.42	61.80	25th	—2.70	3d	2.41	20.59	47 10	28th	—5.00	24th	1.60	25.59	44.10	16th	2.80	13th	3.54
March, . . .	31.08	54.50	31st	7.00	3d	2.12	31.31	57.70	31st	—3.00	4th	0.80	36.74	56.60	28th	3.50	2d, 3d	6.27
April, . . .	41.01	58.30	5th	14.30	2d	7.68	44.37	68.10	3d	28.50	7th	3.20	43.45	71.00	30th	28.79	9th	2.96
May, . . .	55.19	86.40	26th	39.80	16th	6.82	54.10	74.20	31st	40.30	18th	2 98	59.19	86.00	7th, 8th	43.90	11th, 12th	4.08
June, . . .	63.63	86.90	29th	49.00	8th	2.66	66.10	90.30	27th	51.00	15th	4.62	62.80	91.50	29th	45.00	12th	6.16
July, . . .	70.87	90.30	12th	55.50	3d	4.98	69.80	92.00	11th	58.50	24th	6.73	67.73	90.00	12th	53.00	4th, 5th	2.61
August, . . .	67.22	90.30	14th	53.60	19th	3.14	67.90	79.00	8th	58.80	4th	4.82	66.43	81.80	4th	47.40	30th	6.65
September, . .	59.90	85.70	11th	32.60	30th	3.04	50.90	85.20	9th	37.00	29th	4.14	57.10	73.80	27th	41.00	15th	4.47
October, . .	48.90	73.00	13th	25.00	22d	3 88	51.42	73.00	19th	31.50	26th	3.86	45.72	75.00	4th	24.80	26th	1.85
November, . .	39.46	67.00	9th	13.00	26th	2 07	33.91	59.00	1st	14.60	16th	2.16	41.07	65.80	13th	24.00	16th	2.96
December, . .	31.47	52.00	8th	2.20	27th	5.31	25.71	42.80	15th	0	26th	3.16	23 03	62.90	2d	—8.50	29th	4 85
Means and Sums,	46.14	–	–	–	–	47.06	45 40	–	–	–	–	41.59	45.98	–	–	–	–	51.29

MONTHS.	1860.						1861.						1862.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	26.52	50.30	21st	—8.00	2d, 3d	1.21	20.45	38.00	25th	—17.00	13th	4.34	22.31	42.90	1st	0	8th	5.25
February, . .	24.83	52.00	23d	—7.20	18th	2.98	29.22	53.50	28th	—20.00	8th	3.28	22.10	40.00	23d	—2.00	17th	2.84
March, . . .	37.19	71.30	31st	22.80	23d	1.58	32.49	56.30	3d	5.50	7th	3.76	32.17	44.50	24th	13.80	3d	4.30
April, . . .	43.99	68.30	17th	23.10	3d	1.23	45.50	80.30	23d	18.20	4th	5.65	43.55	72.90	17th	24.30	8th	2.28
May, . . .	57.29	81.00	13th	38.90	1st	4.57	53.37	77.20	31st	33.00	2d	4.45	58.13	84.00	17th	44.00	25th	2.33
June, . . .	65.22	83.00	29th	52.00	21st	3.57	65.48	84.00	10th	51.00	6th	2.69	63.39	86.00	28th	49.50	16th	11.69
July, . . .	66.39	84.00	16th	53.00	28th	6.13	69.46	91.70	9th	56.70	2d	5.23	67.98	90.00	6th	51.90	19th	5.12
August,. . .	68.01	84.40	8th	49.10	29th	2.68	65.67	90.00	3d	48.50	15th	4.10	68.11	88.00	9th	48.00	30th	2.98
September, . .	56.78	79.00	7th	32.00	30th	6.12	59.93	82.30	15th	41.60	25th	2.75	61.06	80.00	7th	39.00	26th	2.12
October, . .	43.85	69.90	31st	28.00	1st	2.18	51.52	75.50	3d	25.00	25th	4.53	50.96	83.00	8th	26.00	24th	3.28
November, . .	42.70	66.70	2d	15.00	26th	3.52	37.82	64.00	3d	17.00	26th	3.93	39.56	68.20	1st	18.00	16th	4.76
December, . .	23.87	37.50	21st	—7.00	16th	3.84	29.00	51.40	7th	—6.5	26th	2.17	27.55	52.00	15th	—1.30	8th	1.91
Means and Sums,	46.80	–	–	–	–	39.66	46.66	–	–	–	–	46.93	46.41	–	–	–	–	48.86

MONTHS.	1863.						1864.						1865.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	29.08	52.00	16th	5.00	18th	5.05	24.36	44.20	29th	—1.50	7th	2.20	18.73	39.50	13th	—4.50	28th	3.48
February, . .	26.29	45.30	27th	—9.00	5th	4.43	28.49	46.80	24th	—4.30	18th	1.12	25.03	45.40	23d	—1.00	14th	2.88
March, . . .	26.13	47.30	25th	—6.00	13th	5.60	34.40	53.80	28th	15.00	22d	2.58	37.12	63.70	21st	13.00	6th	5.98
April, . . .	45.48	77.00	28th	25.00	4th	2.33	43.54	64.80	22d	31.80	5th	2.57	49.01	79.50	27th	33.00	9th	2.90
May, . . .	55.35	88.00	22d	38.30	7th	3.59	60.41	86.00	31st	40.00	3d	2.54	57.13	85.80	17th	42.80	1st	7.89
June, . . .	59.03	85.60	15th	51.00	17th	4.09	65.70	93.50	25th	47.30	10th	1.38	69.29	87.00	17th	55.90	3d	2.94
July, . . .	70.87	85.50	27th	55.30	23d	8.64	71.49	91.90	20th	53.90	26th	0.96	69.06	85.40	7th	54.80	15th	3.72
August, . .	70.07	90.00	3d	48.70	31st	6.11	70.82	98.00	1st	54.80	31st	4.40	68.58	90.00	4th	47.50	29th	1.86
September, . .	57.38	80.00	16th	32.00	23d	2.16	57.84	80.00	27th	41.00	26th	2.92	65.62	89.00	1st	35.00	28th	0.37
October, . .	49.90	71.00	19th	21.00	29th	4.04	46.37	68.70	4th	28.50	22d	2.94	45.97	72.00	1st	24.20	24th	4.98
November, . .	41.06	65.40	20th	18.00	30th	5.28	38.04	62.00	30th	10.80	17th	6.20	39.91	68.00	16th	18.50	8th	2.45
December, . .	25.34	51.50	14th	3.20	23d	4.87	30.18	49.40	1st	18.00	23d	4.63	28.92	54.90	27th	6.80	16th	3.54
Means and Sums,	46.33	–	–	–	–	56.19	47.64	–	–	–	–	34.44	47.86	–	–	–	–	42.99

MONTHS.	1866.						1867.						1868.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	21.93	40.00	18th	—14.50	8th	1.36	18.30	33.50	24th	—5.00	16th	1.32	20.21	39.50	3d	0	13th	3.52
February, . .	26.18	55.00	24th	—1.50	7th	4.62	31.23	50.00	14th	8.00	11th	3.65	18.21	45.00	21st	—18.30	8th	1.03
March, . . .	31.64	55.80	15th	11.50	18th	3.16	30.84	53.00	31st	8.00	29th	3.12	33.80	59.80	31st	—7.30	1st	3.25
April, . . .	48.63	84.20	21st	30.00	10th	2.03	45.49	66.00	15th	29.00	14th	3.79	41.96	67.50	1st	23.00	10th	4 27
May, . . .	54.63	80.00	12th	40.00	2d	4.48	54.05	75.50	28th	36.00	3d	4.61	55.13	75.00	7th	36.00	8th	7.86
June, . . .	65.82	90.10	25th	48.00	1st	5.63	67.06	85.00	6th	54.00	11th	5.67	66.17	88.70	20th	51.80	5th	2.44
July, . . .	72.91	94.00	16th	55.00	1st	4.02	68 14	90.00	4th	55.00	31st	4.00	73.97	94.50	15th	61.00	28th	3.28
August, . . .	63.48	81.60	2d	48.00	26th	3.96	63.56	83.50	7th	48.30	31st	0.16	63.07	85.00	31st	51.00	13th	5.67
September, . .	60.00	83.10	31st	35.50	16th	4.71	59.99	80.00	17th	39.00	28th	1.11	59.47	79.50	11th	36.20	18th	10.63
October, . .	49.50	73.00	8th	26.50	5th	3.38	49.90	76.00	18th	27.00	25th	3.85	45.30	63.00	11th	19.20	24th	1.37
November, . .	40.10	60.80	9th	16.80	26th	3.86	37.87	65.00	2d	17.50	18th	4.31	36.48	53.00	1st	23.80	20th	4.80
December, . .	26.39	51.20	7th	—3.80	21st	3.57	22.64	46.00	26th	—3.00	14th	1.51	22.82	42.70	7th	—5.00	27th	1.47
Means and Sums,	46.76	-	-	-	-	44.81	46.17	-	-	-	-	46.10	45.21	-	-	-	-	49.59

MONTHS.	1869.						1870.						1871.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January,	28.04	49.00	8th	3.00	23d	3.47	30.78	54.30	23d	5.00	9th	5.87	23.27	50.00	13th	−5.50	23d	1.96
February,	28.01	50.60	13th	−1.00	8th	4.14	25.34	55.00	18th	6.20	25th	5.25	25.95	50.60	25th	−9.50	5th	2.91
March,	27.28	53.80	27th	−9.00	1st	5.46	30.88	50.50	31st	6.50	6th	2.71	40.53	55.50	19th	24.80	29th	3.99
April,	46.45	74.00	20th	26.70	4th	1.53	48.26	78.00	14th	35.00	4th	3.70	48.00	74.80	9th	27.00	1st	3.09
May,	55.87	83.00	12th	35.20	2d	5.65	58.27	82.40	16th	42.80	11th	1.72	57.84	92.80	30th	41.00	5th	3.82
June,	64.72	80.70	29th	47.40	8th	5.99	70.45	93.00	25th	53.50	11th	2.73	65.38	88.20	3d	51.80	10th	6.58
July,	69.08	89.90	16th	53.50	2d	2.98	73.55	91.20	24th	54.50	2d	2.53	69.18	85.60	13th	54.00	11th	3.52
August,	66.87	87.20	20th	50.00	31st	1.04	71.11	91.30	19th	47.00	27th	2.83	68.87	85.00	7th	50.00	26th	6.45
September,	62.06	85.00	20th	36.30	28th	4.32	62 32	83.50	1st	40.00	12th	1.75	52.84	78.00	3d	32.00	22d	1.30
October,	46.68	71.40	2d	26.80	28th	11.36	52.02	71.50	2d	26.00	27th	4.49	50.95	73.10	23d	24.30	22st	6.09
November,	35.92	56.90	4th	16.90	26th	2.59	39.10	61.00	9th	24.70	17th	3.28	34.03	62.00	1st	7.00	30th	3.51
December,	27.48	45.30	1st	−7.50	9th	4.96	28.00	47.00	2d	1.00	30th	1.84	24.62	43.20	4th	−6.50	21st	2.67
Means and Sums,	46.54	–	–	–	–	53.49	49.17	–	–	–	–	38.70	46.79	–	–	–	–	45.89

MONTHS.	1872.						1873.						1874.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	25.11	42.90	20th	2.50	31st	1.51	20.56	42.30	14th	—22.00	30th	5.01	28.15	52.00	23d	1.20	26th	5.46
February, . .	24.16	50.00	25th	—2.50	1st	1.89	24.00	45.00	4th	—2.50	24th	2.17	24.48	49.30	20th	—5.00	2d	2.19
March, . . .	25.27	44.00	28th	—4.80	5th	2.87	30.64	49.30	29th	1.80	6th	3.18	32.93	57.20	26th	9.70	24th	1.35
April, . . .	45.03	84.00	26th	29.00	2d	2.20	43.23	66.20	29th	33.50	11th	1.74	38.32	63.00	14th	18.70	1st	6.03
May, . . .	59.14	84.10	9th	43.70	4th	3.11	54.58	82.00	28th	39.00	3d	3.91	56.52	86.00	29th	39.00	7th	5.22
June, . . .	68.14	91.80	30th	48.70	2d	3.25	67.48	90.00	19th	50.60	4th	1.59	66.18	93.00	29th	51.30	2d	5.06
July, . . .	72.64	91.70	1st	59.10	23d	7.07	71.30	92.40	14th	56.10	19th	2.93	67.16	90.00	14th	38.00	5th	11.58
August, . .	71.60	88.80	8th	52.90	31st	5.28	67.01	86 20	2d	49.10	28th	3.47	65.58	84.00	10th, 11th	46.30	27th	2.69
September, . .	61.70	83.50	8th	39.50	4th	6.20	69.35	85.80	5th	36.20	22d	4.77	62.03	85.80	10th	39.00	23d	1.82
October, . .	48.24	69.00	6th	29.90	30th	3.64	49.93	70.50	19th	27.00	26th	6.36	47.60	66.00	8th	28.50	22d	1.85
November, . .	36.43	54.00	12th	10.00	30th	4.48	29.68	52.00	2d	6.50	28th	3.51	36.21	60.00	6th	16.00	11th	3.54
December, . .	19.50	40 30	2d	—8.00	30th	2.69	29.23	57.70	4th	7.00	1st	3.31	20.29	49.00	3d	0	31st	1.17
Means and Sums,	46.41	–	–	–	–	44.19	45.67	–	–	–	–	41.95	46.21	–	–	–	–	47.96

MONTHS.	1875.						1876.						1877.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	16.73	35.50	2d	—8.20	11th	2.96	29.85	63.00	1st	2.80	14th	2.31	20.05	46.00	27th	—3.50	24th	2.52
February, . .	17.53	50.00	23d	—4.00	10th	3.62	26.36	52.30	13th	—1.00	24th	5.53	30.78	50.00	22d	8.50	9th	0.36
March, . . .	27.79	51.00	30th	0	24th	4.20	31.60	59.00	7th	4.50	20th	7.14	33.30	52.80	23d	10.00	20th	6.97
April, . . .	40.80	63.00	29th	22.50	19th	3.33	43.60	63.30	14th	28.00	9th	3.11	47.80	75.80	24th	32.50	14th	2.45
May, . . .	57.14	84.70	23d	39.80	2d	2.19	57.50	86.00	7th	39.00	1st	3.96	58.50	84.50	31st	40.00	2d	1.93
June, . . .	65.84	89.00	24th	48.50	14th	2.89	70.61	87.70	27th	47.00	1st	3.87	67.77	88.00	2d	54.70	23d	4.59
July, . . .	69.30	91.50	6th	53.80	20th	8.15	74.19	95.00	9th	52.50	27th	4.84	71.13	89.10	26th	58.10	15th	6.47
August, . . .	68.94	84.80	31st	32.00	27th	6.17	70.54	90 00	6th	49.00	21st	0.27	71.35	87.40	28th	54.80	31st	2.79
September, . .	57.27	84.70	3d	32.50	23d	4.65	59.10	90.00	1st	41.20	27th	3.71	63.31	85.70	14th	39.00	23d	0.91
October, . .	47.90	70.30	5th	26.00	13th	3.89	45.50	71.10	21st	23.00	29th	1.12	50.50	75.40	1st	25.30	28th	6.99
November, . .	33.11	56.20	13th	—1.00	30th	3.97	40.50	71.70	2d	18.90	30th	2.40	41.92	66.80	9th	19.40	20th	5.44
December, . .	28.26	55.00	23d	—9.00	20th	1.03	19.70	42.00	13th	—1.00	17th	3.22	33.09	55.20	17th	13.00	2d	1.02
Means and Sums,	44.22	–	–	–	–	46.99	47.42	–	–	–	–	41.57	49.12	–	–	–	–	42.44

MONTHS.	1878.						1879.						1880.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January,	25.29	44.40	22d	—12.50	8th	3.58	21.55	50.10	28th	—4.50	17th	1.75	31.60	47.90	4th	2.00	14th	4.58
February,	27.14	53.30	27th	—3.20	3d	3.67	22.37	43.20	12th	1.00	22d	3.49	29.09	57.60	29th	—11.50	10th	3.60
March,	39.24	65.10	10th	13.20	25th	2.57	33.00	51.60	11th	7.00	8th	4.98	33.46	59.80	4th	13.70	25th	2.68
April,	52.17	73.10	19th	37.00	15th	5.85	43.18	72.40	28th	22.70	4th	3.85	47.54	77.70	14th	26.20	8th	2.64
May,	57.38	83.20	3d	40.50	13th	2.36	60.60	83.00	31st	40.00	2d	3.32	64.15	93.00	26th	37.00	1st	1.90
June,	64.73	90.20	30th	46.40	7th	6.00	66.26	90.30	1st	49.00	7th	5.37	68.52	91.10	24th	51.00	4th	1.40
July,	73.33	92.20	18th	55.20	7th	2.16	71.00	91.40	4th	56.70	5th	5.75	71.81	90.50	10th	54.00	30th	6.34
August,	68.63	83.30	9th	49.90	26th	6.97	67.19	90.60	2d	53.20	28th	5.89	67.53	88.00	23d	45.70	16th	2.91
September,	63.20	84.50	1st	37.00	28th	2.82	59.02	85.60	2d	30.40	26th	2.59	63.24	90.00	5th	39.10	24th	2.69
October,	54.43	77.30	17th	27.00	29th	2.05	56.01	82.60	16th	20.80	26th	1.80	47.27	71.40	11th	22.90	29th	2.27
November,	39.11	57.20	2d	19.80	15th	5.34	37.37	68.20	15th	7.70	5th	2.35	34.91	59.20	6th	9.50	23d	2.50
December,	28.95	53.70	2d	11.70	29th	6.02	30.83	54.50	3d	—6.00	26th	4.85	22.79	38.90	6th	—5.00	31st	2.29
Means and Sums,	49.47	–	–	–	–	49.39	47.36	–	–	–	–	45.90	48.49	–	–	–	–	35.80

MONTHS.	1881.						1882.						1883.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	17.92	38.00	7th	—12.40	1st	4.01	23.57	45.00	26th, 16th	—15.00	24th	5.44	21.00	42.20	31st	—2.50	23d	3.24
February, . .	24.86	47.00	10th	—7.00	2d	1.77	28.19	47.40	16th	—6.00	4th	4.23	25.02	43.10	4th	—1.30	24th	4.03
March, . . .	36.20	50.80	16th	24.40	2d	4.86	35.13	56.20	20th	17.40	15th	5.20	27.26	51.10	2d	3.00	9th	1.70
April, . . .	43.65	78.40	24th	22.10	5th	1.65	44.31	68.00	18th	23.70	1st	1.52	44.29	67.30	10th	23.50	1st	2.18
May, . . .	61.70	89.00	25th	37.00	1st	4.28	52.86	78.00	31st	39.10	3d	6.50	58.60	89.00	26th	43.00	1st	6.20
June, . . .	62.77	80.00	29th	47.70	4th	3.95	66.85	90.00	24th	52.20	1st	2.25	69.72	90.80	19th	53.70	2d	3.99
July, . . .	70.64	87.20	13th	59.20	1st	1.50	71.89	92.10	27th	56.30	1st	1.83	70.42	93.00	4th	55.00	1st	3.69
August, . .	70.49	90.80	5th	56.70	17th	2.76	70.89	93.00	15th	49.70	19th	0.25	66.39	86.20	20th	43.40	28th	1.57
September, . .	67.35	94.00	7th	49.00	14th	2.37	63.23	87.70	19th	43.70	13th	11.85	59 43	79.80	2d	36.20	10th	3.17
October, . .	52.47	86.20	1st	29.00	27th	4.24	52.72	73.80	8th	32.20	28th	1.67	46.82	77.10	14th	23.20	18th	4.31
November, . .	40.30	66.70	9th	14.00	23d	4.58	36.45	66.10	1st	12.00	28th	1.33	40.43	67.20	22d	18.00	29th	1.80
December, . .	36 01	61.40	14th	8.50	11th	6.15	26.65	48.00	24th	0	20th	1.47	27.02	53.10	8th	—12.80	23d	2.99
Means and Sums,	48.70	–	–	–	–	42.12	47.73	–	–	–	–	43.54	46.36	–	–	–	–	38.87

MONTHS.	1884.						1885.						1886.					
	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.		Mean.	Maximum.	Date.	Minimum.	Date.	
January, . .	21.64	40.10	18th	—8.00	6th	3.60	22.73	57.00	12th	—18.00	28th	3 78	21.85	56.00	5th	—22.00	13th, 14th	5.39
February, . .	30.86	46.00	7th	5.10	29th	4.62	15.17	39.00	26th	—15.00	12th	3.88	23.10	52.00	15th	—11.00	5th	3.94
March, . . .	32.89	54.00	25th	0	3d	5.67	23.29	50.00	28th	—11.00	18th	0.86	33.46	61.00	31st	—1.00	1st	3.31
April, . . .	46.69	70.30	27th	31.20	1st	2.48	45.29	83 00	22d	19.00	15th	3.38	50.42	83.00	20th	21.00	7th	1.73
May, . . .	57 35	85.20	22d	37.60	29th	2.02	54.77	85.00	19th	21.00	4th	3.08	57.26	82.00	30th	29.00	1st	3.10
June, . . .	69.00	92.50	21st	50.00	15th	1.38	63.76	89.00	16th	35.00	6th, 10th	3.49	63.20	82.00	21st	40.00	4th, 19th and 20th	2.33
July, . . .	68.64	93.00	2d	57.10	16th	3.75	70.41	93.00	17th	41.00	2d	2.07	68.80	95.00	4th	41.00	1st	3.82
August, . .	69.25	92.40	20th	48.80	25th	5.10	66.05	87.00	1st, 18th	34.00	28th	8.31	66.30	90.00	27th	39.00	22d	2.60
September, . .	64.35	90.00	10th	39.00	14th	1.25	58.32	81.00	14th	27.00	11th	0.85	59.50	83.80	9th	31.00	21st	5.48
October, . .	50.27	78.20	4th	26.50	26th	2 40	49.14	80.00	4th	24.00	26th	3.65	48.90	77.90	9th	17.00	17th	2.97
November, . .	38.43	61.00	23d	19.80	25th	2.53	39.80	70.00	8th	11.00	28th, 29th	5.54	38.34	65.50	2d	15.90	28th	5.25
December, . .	30.00	57.40	7th	—10.00	20th	5.58	29.59	65.00	10th	6.00	21st, 22d	3.54	22.99	49.00	11th	0.80	30th	3.61
Means and Sums, .	48.29	–	–	–	–	40.38	44.86	–	–	–	–	42.43	46.17	–	–	–	–	43.53

MONTHS.	1887.					
	Temperature.					Rain in Inches.
	Mean.	Maximum.	Date.	Minimum.	Date.	
January,	19.39	47.20	24th	—22.20	19th	4.57
February,	24.15	43.80	9th	—3.80	5th	5.05
March,	26.41	46.00	21st	—2.40	5th	4.05
April,	41.61	74.40	10th	17.10	8th	2.98
May,	60.91	86.50	20th	33.20	14th	1.13
June,	65.67	91.00	30th	38.50	11th	5.09
July,	73.71	93.60	2d	56.00	15th	8.93
August,	64.92	88.00	1st	42.50	14th, 28th	7.75
September,	55.94	80.00	7th	29.50	27th	1.22
October,	47.00	74.40	8th	17.00	31st	2.10
November,	36.49	64.80	7th	11.00	30th	3.35
December,	26.65	51.00	12th	—6.00	31st	4.11
Means and Sums,	45.23	–	–	–	–	50.33

C. A. GOESSMANN,

Director.

JAMES P. LYNDE, *Treasurer, in Account with* MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

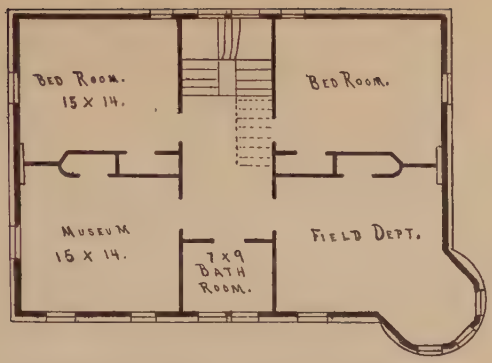
1887.	*Receipts.*		1887.	*Expenditures.*	
Jan. 1,	Cash in Bank,	$400 99		Salaries,	$3,191 45
1,	Dr. C. A. Goessmann, Director,	77 82		Laboratory Supplies,	818 50
7,	State Treasurer,	2,500 00		Printing and Postage,	782 17
April 1,	State Treasurer,	2,500 00		Office Expenses,	201 34
11,	Dr. C. A. Goessmann, Director,	155 01		Farmer and Farm Labor,	1,842 05
June 22,	Dr. C. A. Goessmann, Director,	117 80		Farm Supplies,	560 82
July 6,	State Treasurer,	2,500 00		Stock and Feed,	645 92
Oct. 1,	State Treasurer,	2,500 00		Miscellaneous Expenses,	364 38
11,	Dr. C. A. Goessmann, Director,	178 30		Repairs and Construction,	1,736 43
				Horses,	375 00
				Expenses of Board of Control,	148 75
				Cash in Bank Dec. 31, 1887,	263 11
		$10,929 92			$10,929 92

ATHOL, Jan. 1, 1888.

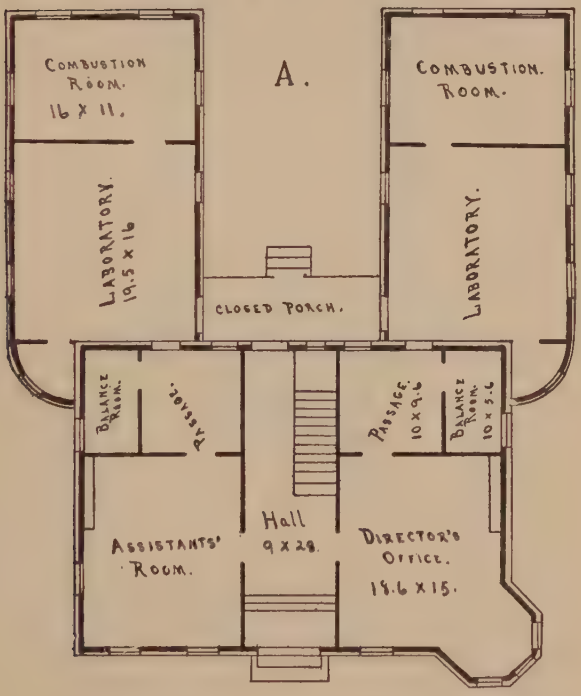
JAMES P. LYNDE, *Treasurer.*

Examined, compared with the vouchers, and found correct. ALVAN BARRUS, *Auditor of the Board of Control.*

B.



STATION BUILDING — 2nd FLOOR.



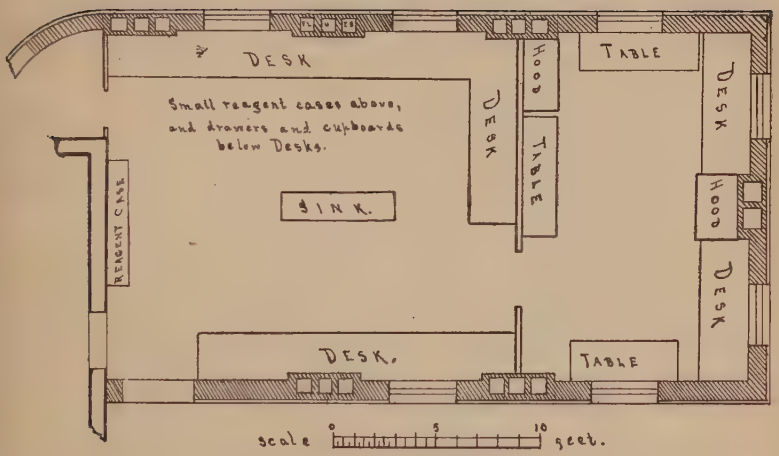
Scale 0 5 10 feet.

STATION BUILDING — GROUND PLAN.

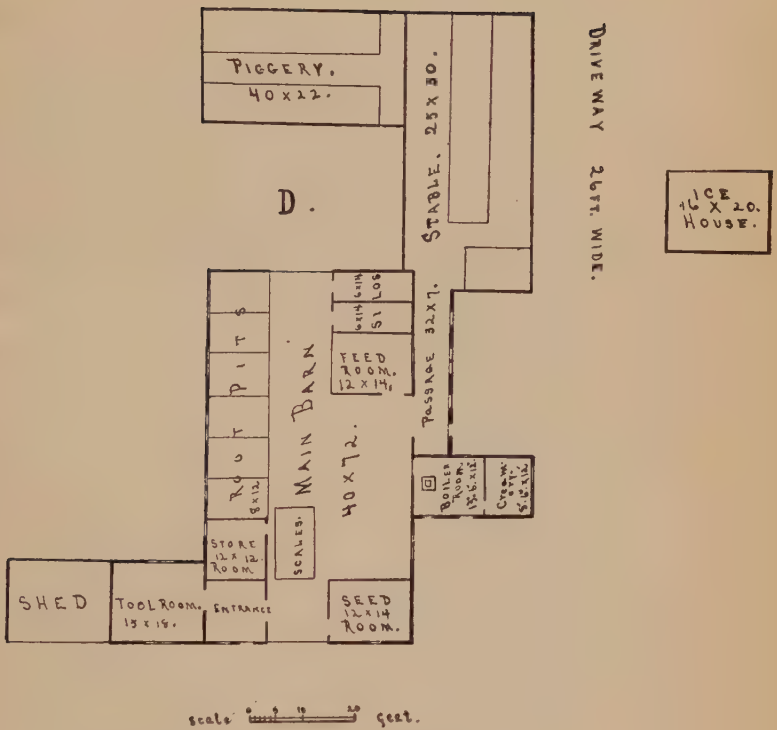
A. Laboratory Building..... Ground Plan

B " " Second Floor

C.



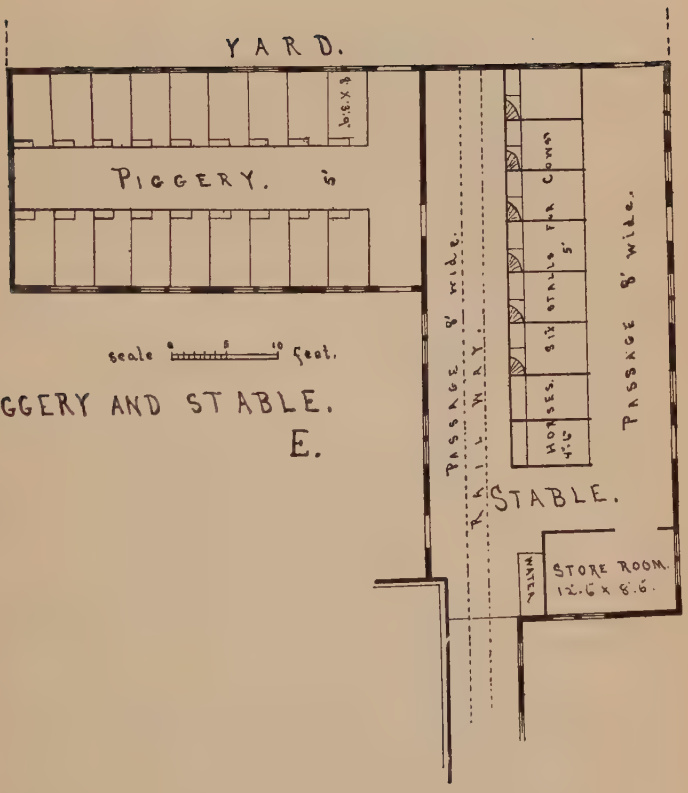
PLAN OF LABORATORY.



PLAN OF FARM BUILDINGS.

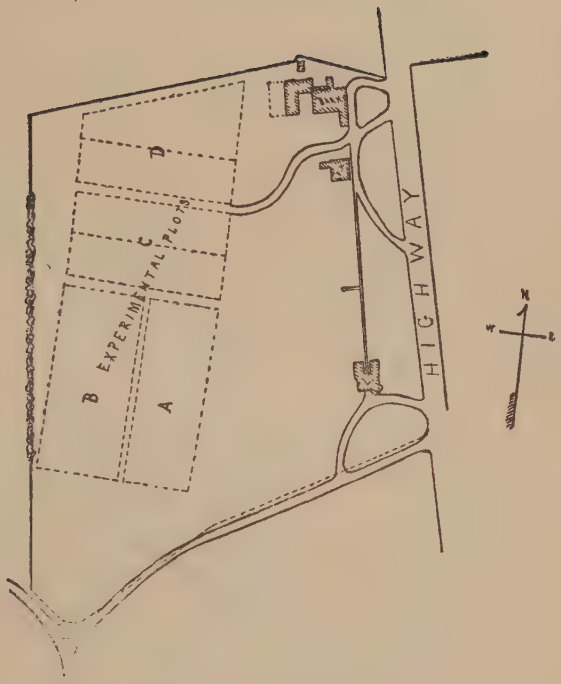
C. ONE WING OF CHEMICAL LABORATORY

D. PLAN OF FARM BUILDINGS.



PIGGERY AND STABLE.

E.



Map of Land Leased to the

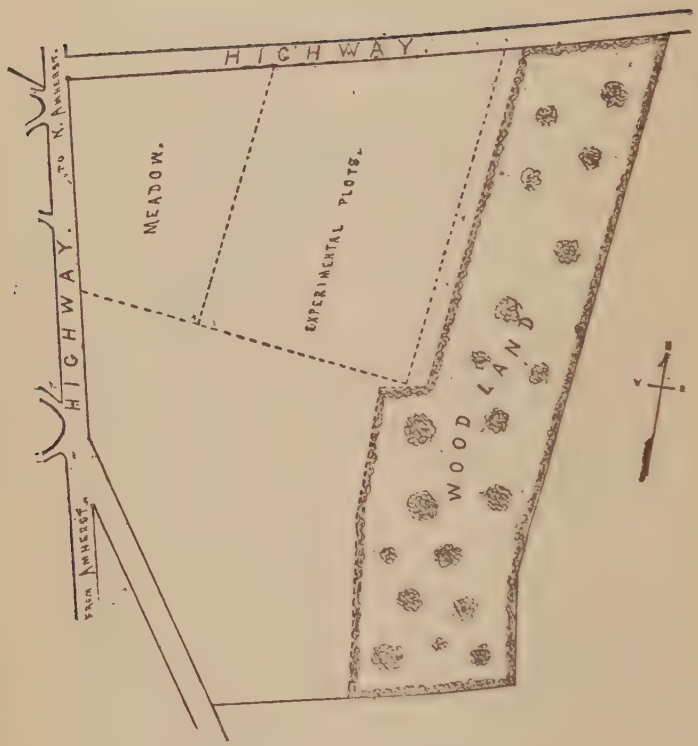
MASSACHUSETTS EXPERIMENT STATION,

from the

AGRICULTURAL COLLEGE FARM,

West of the Highway.

Area taken, 17.72 Acres.



MAP OF LAND LEASED TO THE

MASSACHUSETTS EXPERIMENT STATION,

FROM THE

AGRICULTURAL COLLEGE FARM,

EAST OF THE HIGHWAY.

Area taken, 30.52 Acres.

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